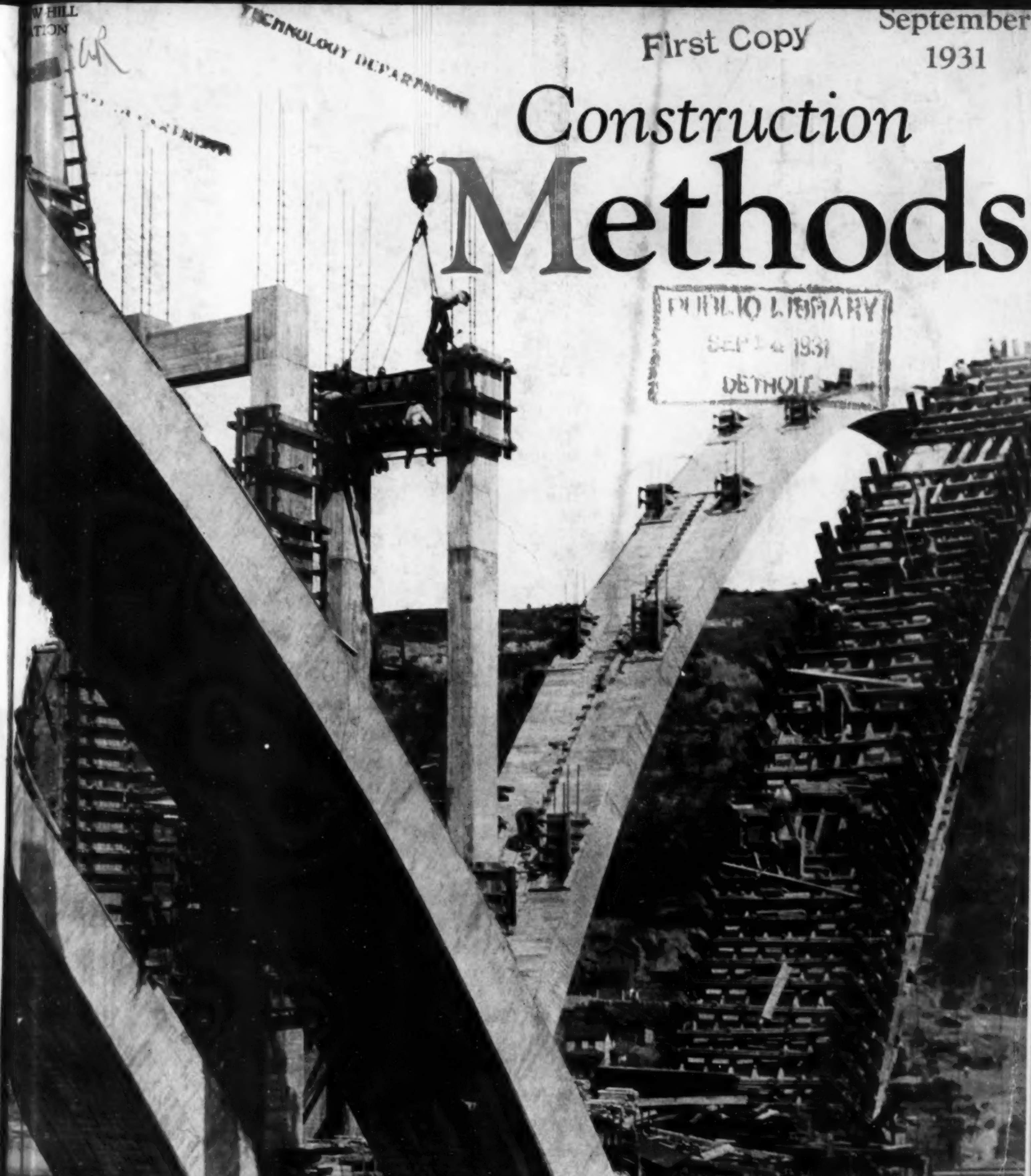
First Copy

September 1931

Construction Methods



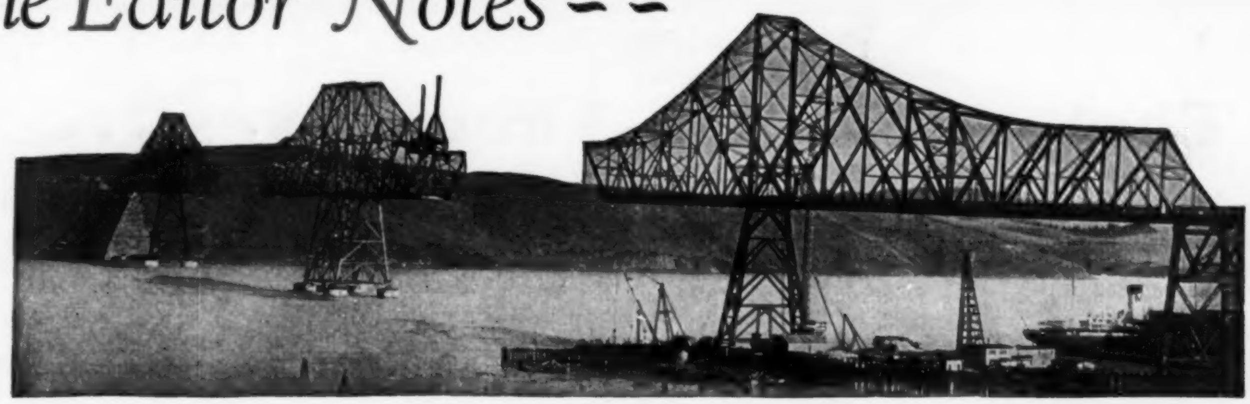
inghouse Bridge, Pittsburgh, two-rib arches, with record main span of 460 ft.

A MONTHLY REVIEW OF FIELD PRACTICE AND EQUIPMENT

General Construction · Highways · Buildings · Engineering · Industrial

CONSTRUCTION METHODS, September, 1931. Vol. 13, No. 9. Published monthly. McGraw-Hill Publishing Company, Inc., Tenth Avenue at Thirty-sixth Street, New York, N. Y. $1 per year; 10 cents per copy. Entered as second-class matter. October, 1926 issue. Vol. 8, No. 19, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

The Editor Notes --



Methods of Curing Concrete Pavements

IN THESE days the construction of a concrete pavement moves ahead so rapidly, and so much more is put down in a day or a week than was the case just a short time ago, that the problem of obtaining adequate curing of the concrete has taken on new aspects. Although most highway engineers still think that the most favorable curing condition exists when the slab is kept damp during the curing period by means of a wet covering of earth, sand, hay, straw, etc., sometimes practical difficulties arise that make other methods appear attractive. Difficulty in providing an adequate water supply for keeping some two miles of cover properly wet, difficulty in obtaining thorough compliance with the specifications so far behind the crew, and lack of opportunity to inspect the finished work, are some of the factors that have opened the way to the use of other methods.

For two years a special committee of the Highway Research Board has been studying curing of concrete and gathering facts concerning the more extensively used methods. A review of the available data is presented in the progress report of this committee in the Tenth Annual Proceedings of the board.

Although research studies have not yet progressed to a point where definite standards of comparison for different curing methods can be set up, considerable information is available on strength, surface condition and volume change, all of which give some indication of curing qualities.

Surface applications of calcium chloride in regions where the air temperature and humidity are such that the salt will readily dissolve, according to R. W. Crum, director of the board, have been found to produce concrete 90 per cent or more as strong as concrete cured with a wet cover, with no greater changes in volume. This

CONSTRUCTION METHODS
A monthly review of modern construction practice and equipment

ROBERT K. TOMLIN, *Editor*
Editorial Staff
VINCENT B. SMITH NELLE FITZGERALD
J. I. BALLARD (San Francisco)

WILLARD CHEVALIER, *Publishing Director*

A McGraw-Hill Publication
Tenth Avenue at 36th Street, New York

method has not been found to be a primary cause of surface scaling in appreciable amounts.

Concrete cured with bituminous coatings in general showed strength 90 per cent or more of that of wet cured concrete. Volume changes as evidenced by temperature ranges, direct measurement and crack surveys are greater, indicating that more frequent shrinkage cracks are to be expected unless prevented by proper joint spacing. Coating the bituminous covered surface as soon as possible with some light colored material, such as whitewash, appears to decrease the volume changes.

Big Output From Dragline

An impressive yardage of earth moved by dragline during one month is reported by Ulen & Co. on its $6,000,000 irrigation and power project in Maverick County, Texas. During 31 days in January a 240-hp. diesel-powered dragline, with 6-yd. bucket and 120-ft. boom, excavated 247,000 cu.yd. of silty loam and gravel on the Trinity Farm project. The run was made through a 25-ft. cut, from which earth was spoiled 200 ft. from the center line. In comparing this output with some of the high dragline yardages moved on levee-building work along the Mississippi River, it is well to recall that on the Texas project the cut made by the dragline bucket was not limited to the comparatively shallow borrow-pit cuts required on the Mississippi work.

Largest Concrete Arch in the United States

WHAT will be the longest reinforced concrete arch in the United States is under construction for the George Westinghouse bridge at East Pittsburgh, Pa., a five-arch structure, 1,500 ft. long with the span of the central arch measuring 460 ft. between pier centers. As described in this issue, the methods and the equipment being used by the Booth & Flinn Co., the contractors building the structure for Allegheny County, are of particular interest to the construction man.

Crossing Turtle Creek valley at a high level the long structure, involving the placement of a large yardage of concrete, offered opportunity for effective use of a three-track tower cableway with a span of 1,650 ft. between head and tail towers for handling forms and centering and delivering concrete.

Of primary interest, of course, are the details of steel centering and forms, especially for the record-breaking main arch span. Each of the five bridge spans consists of two arch ribs, spaced 32 ft. apart on centers so that the lateral shifting of the heavy trussed centering from one rib to the other, after the first pour of concrete had cured, presented interesting field methods.

For the main arch span of 460 ft. between piers a pair of tall structural steel and timber towers had to be set up to carry the centering. For all forms watertightness was an essential insisted on by the contractor and tongue-and-groove lumber was employed to obtain that result.

Equipment Replacement

In every depression Andrew Carnegie, it is said, got his plants ready for the next period of business activity by junking and replacing out-of-date equipment.

They Speak for Themselves . . .

July 1—*A Reader Asks:*

"On page 39 of the June 1931 issue of *Construction Methods* the writer notes that the August number will contain a portrayal of the methods used in making multiple-main river crossings with large gas transmission mains.

"Would it be possible for you to furnish an advance copy of the written matter to accompany this article so that the writer could have the benefit of it within the next few days?

"If the cost for this series is greater than the usual charge for making photostatic prints, will you kindly advise the writer so that we can send a formal order?"

July 6—*The Editor Answers:*

"With this letter I am mailing to you a revised copy of the text for our article on the construction of a submerged river crossing for a large gas transmission main. After you have completed your use of this copy, I wish you would return it to me. You may keep the material as long as you need it.

"If I can give you any further assistance on the subject of river crossings, please be sure to call upon me."

July 7—*The Reader Acknowledges:*

"As per your request we are returning herewith advance copy of the article relative to submarine gas pipe river crossing which is to appear in the August issue of *Construction Methods*. We have had copies of this article made for our use.

We appreciate very much this service that you have given to us as one of your subscribers, and we thank you for the prompt response which you made to our request.

"As you probably know, we constructed a very interesting river crossing last year. We are now contemplating the construction of another river crossing, but this time in water up to 70 ft. deep. If you happen to run across any other descriptions of ingenious construction methods suitable for this purpose, we would be glad to have you let us know about them."

All of which shows rather clearly how the readers of CONSTRUCTION METHODS—Well, why not let the letters speak for themselves?

Willard Chevalier

Publishing Director

McGRAW-HILL PUBLISHING COMPANY, INC., TENTH AVENUE AT 36TH STREET, NEW YORK, N. Y.

CABLE ADDRESS: "MACHINIST, N. Y."

JAMES H. MCGRAW, *Chairman of the Board*
MALCOLM MUIR, *President*
JAMES H. MCGRAW, JR., *Vice-Pres. and Treas.*
MASON BRITTON, *Vice-President*
EDGAR KOBAK, *Vice-President*
HAROLD W. MCGRAW, *Vice-President*
H. C. PARMELEE, *Editorial Director*
C. H. THOMPSON, *Secretary*

Member A.B.C.
Member A.B.P.

NEW YORK, *District Office, 285 Madison Avenue*
BOSTON, *1427 Statler Building*
WASHINGTON, *National Press Building*
CHICAGO, *520 North Michigan Avenue*
PHILADELPHIA, *1600 Arch Street*
DETROIT, *2-257 General Motors Building*
CLEVELAND, *Guardian Building*
GREENVILLE, S. C., *1303 Woodside Building*
ST. LOUIS *Bell Telephone Building*
SAN FRANCISCO, *883 Mission Street*
LOS ANGELES, *632 Chamber of Commerce Bldg.*
LONDON, *Aldwych House, Aldwych, London, W.C. 2*

One of a fleet of Autocars recently purchased by O. T. Harlow, Mt. Ranier, Md., who began buying Autocars nine years ago. In busy times, Mr. Harlow often drives a truck himself. He knows his equipment personally—as it operates on the job and as it appears on the books. That's why he continues to buy Autocars. Complete specifications of the Model D illustrated may be had by writing The Autocar Company, Ardmore, Pa.

AUTOCARS HAULED 2,500,000 BRICKS FOR THE NEW DEPARTMENT OF AGRICULTURE BUILDING

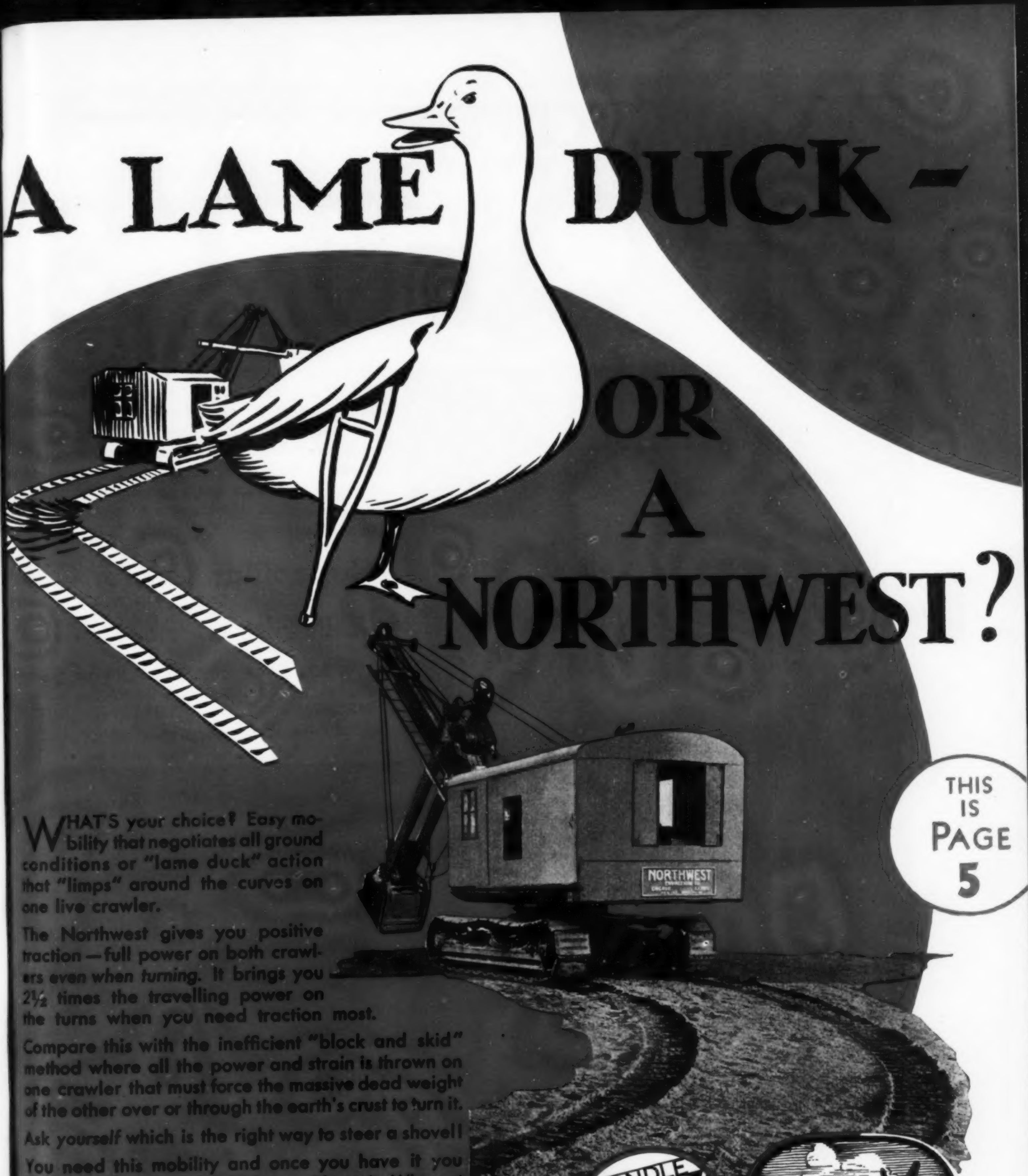
Two million dollars of the $250,000,000 Federal building program has been spent to erect a new Department of Agriculture building. The old quarters had become obsolete. They were out-of-date. There was not sufficient room to house the department's many bureaus. The new building is modern. Despite its cost, it will be economical, for it will soon pay for itself by increasing the efficiency of the department.

There is nothing obsolete about the modern line of Autocar trucks. They're modern. They're efficient. They're profitable. That's why the fleet of Autocars owned by O. T. Harlow, Mt. Ranier, Md., hauled 2½ million bricks and all the sand used in the new Department of Agriculture building.

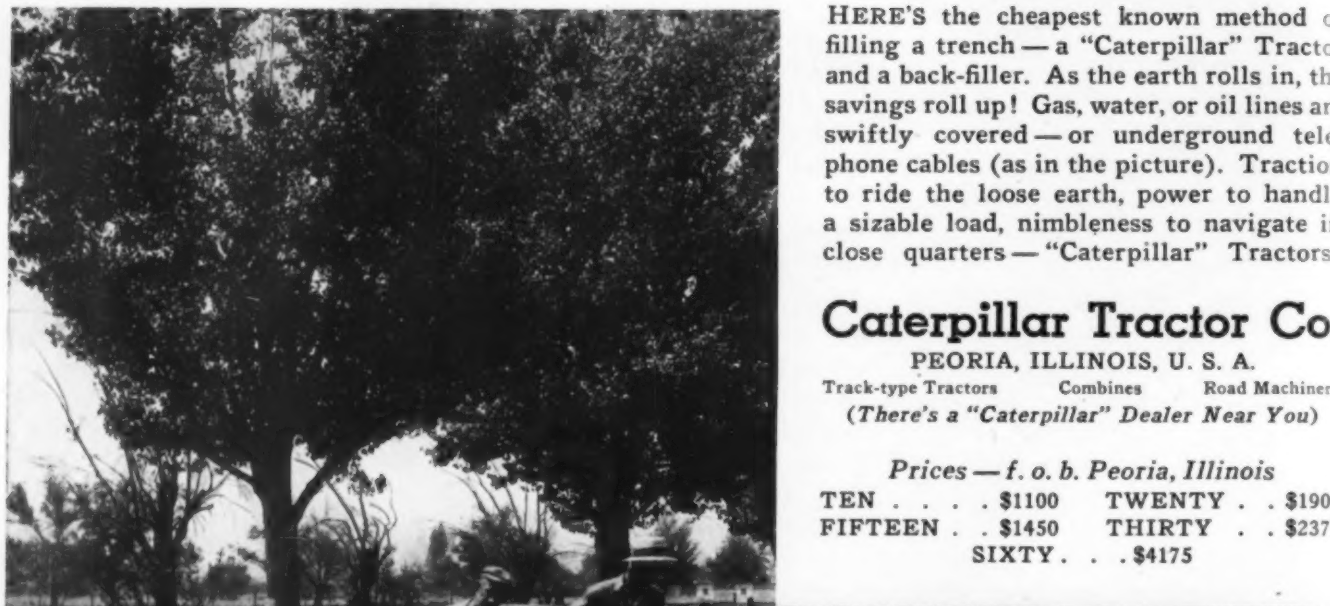
There are more contracts and more profits for the contractor who has replaced his obsolete equipment with modern, heavy-duty, high-speed, precision-built Autocars. Buy them!

AUTOCAR
PRECISION BUILT
TRUCKS

THE AUTOCAR COMPANY, *Ardmore, Pa.*


A LAME DUCK -
OR
A
NORTHWEST?
THIS IS PAGE 5
NORTHWEST
WHAT'S your choice? Easy mobility that negotiates all ground conditions or "lame duck" action that "limps" around the curves on one live crawler.
The Northwest gives you positive traction — full power on both crawlers even when turning. It brings you 2½ times the travelling power on the turns when you need traction most.
Compare this with the inefficient "block and skid" method where all the power and strain is thrown on one crawler that must force the massive dead weight of the other over or through the earth's crust to turn it.
Ask yourself which is the right way to steer a shovel!
You need this mobility and once you have it you will wonder how you got along without it. Why not ask about it?
NORTHWEST ENGINEERING CO.
The world's largest exclusive builders of gasoline, oil burning and electric powered shovels, cranes and draglines
1728 Steger Building 28 East Jackson Boulevard
Chicago, Ill., U. S. A.
HANDLE 25% HARDER DIGGING
NORTHWEST
THE MOST MOBILE SHOVEL ON THE MARKET
SHOVELS—CRANES—DRAGLINES—PULLSHOVELS—SKIMMER-SCOOPS
CM9Gray

• ROLLING UP PROFITS



HERE'S the cheapest known method of filling a trench — a "Caterpillar" Tractor and a back-filler. As the earth rolls in, the savings roll up! Gas, water, or oil lines are swiftly covered — or underground telephone cables (as in the picture). Traction to ride the loose earth, power to handle a sizable load, nimbleness to navigate in close quarters — "Caterpillar" Tractors!

Caterpillar Tractor Co.

PEORIA, ILLINOIS, U. S. A.

Track-type Tractors   Combines   Road Machinery

(There's a "Caterpillar" Dealer Near You)

Prices — f. o. b. Peoria, Illinois

TEN	$1100	TWENTY	$1900
FIFTEEN	$1450	THIRTY	$2375
SIXTY	$4175		

CATERPILLAR

REG. U. S. PAT. OFF.

TRACTOR

60 Ransome

BIG MIXERS

selected for 38 Central Mixing Plants

Ransome three yard mixer in the plant of T. L. Herbert & Sons, Nashville, Tenn.

HERE is the list of the various sizes that have been selected by prominent owners of Central Mixing Plants:

13—1	yard	Ransome	Mixers
8—1½	"	"	"
18—2	"	"	"
20—3	"	"	"
1—4½	"	"	Mixer

Big Operators and Big Jobs demand *Ransome* Big Mixers

and three Big Reasons guided their choice:

RANSOME BIG MIXERS—

1. Mix highest quality concrete
2. Discharge fast and clean
3. Cost least to maintain

and the Ransome Spiral Cut-off Water Tank gives *quick* and *accurate* control.

The mixer is the heart of the Central Mixing Plant. Before you select a mixer visit the plants now in operation and see what mixers are best serving the field.

Send for Bulletin No. 122

Ransome Concrete Machinery Company

1850—Service for 81 Years—1931

Dunellen **New Jersey**

DIGGING UP PROFITS *by the yard*

. . . . . an Owen makes every load pay—saving days and dollars . . . . .

Put an Owen Bucket on the job and you assure a profitable contract right from the start.

More yardage per hour—that's how an Owen produces. Cutting down time, speeding up work, lowering operating costs, saving labor.

"A Bigger Day's Work Than Any Other Bucket of the Same Weight and Capacity"—that's how the Owen Guarantee stands behind Owen performance. A positive, active guarantee that has proved its claims year in and year out, ever since the first Owen Bucket was built.

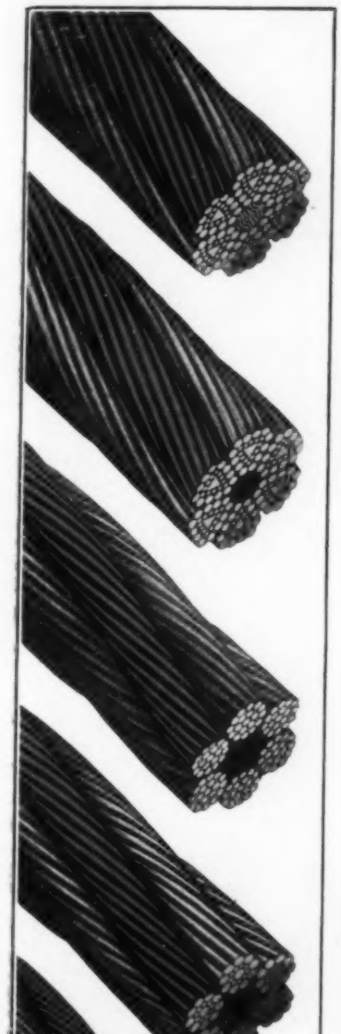
You can make more money with an Owen—because it always does a bigger, better job. Write for an illustrated Owen folder showing graphically the 17 Points of Superiority in clamshell bucket construction.

**The Owen Bucket Company, 6022 Breakwater Ave.
Cleveland, Ohio**

OWEN CLAMSHELL BUCKETS

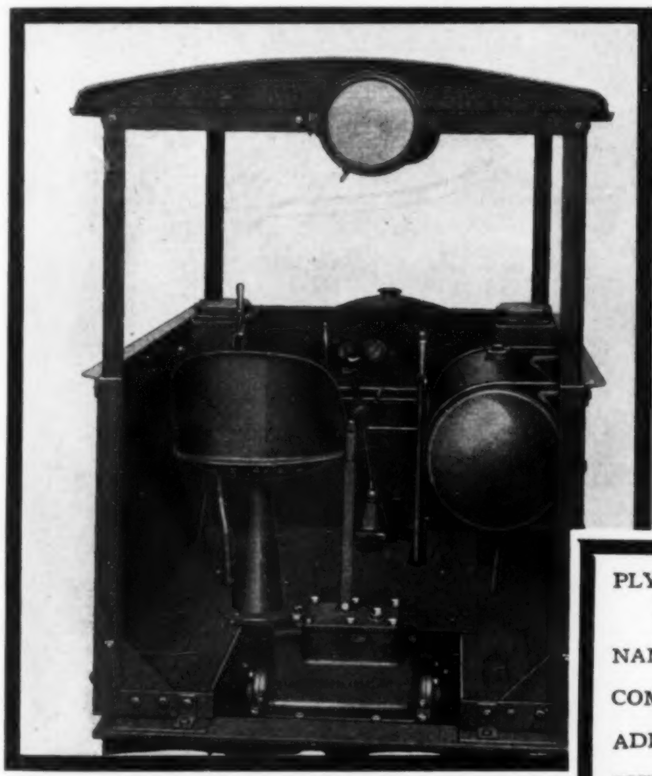
Owen Buckets

A MOUTHFUL AT EVERY BITE



new!

Plymouth Model TLF $2\frac{1}{2}$, 3, $3\frac{1}{2}$ and 4 Ton Gasoline Locomotives with Ford Engine *and* 4 Speed Truck Transmission



Rear view showing unobstructed vision and accessibility of control levers

DESIGNED and built to give the same satisfactory service that the thousands of other Plymouths are giving.

Its low price and economy of operation and maintenance make it especially attractive.

The ability to obtain repair parts and service on the Ford engine from any of the 8,300 authorized Ford Dealers throughout the country is another important feature.

This locomotive makes an ideal unit for construction work, quarries, sand, gravel and clay plants, mines, lumber camps and mills, plantations and general industrial haulage.

Write for Bulletin TLF.

TEAR OFF AND MAIL COUPON—NOW!

PLYMOUTH LOCOMOTIVE WORKS, Plymouth, Ohio
Please send Bulletin TLF (without obligation) to

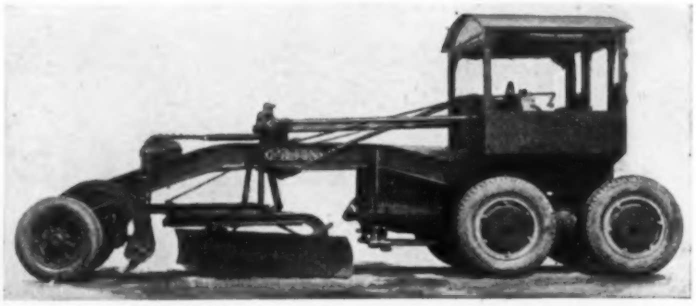
NAME....................................TITLE.............
COMPANY...
ADDRESS...
CITY....................................STATE............

PLYMOUTH

Gasoline and Diesel Locomotives

Three Recent Developments by GALION

DOUBLE DRIVE MOTOR GRADERS



Galion Motor Patrol Graders are now equipped with center drive, which is geared to each set of wheels. This balanced drive construction permits full oscillation and perfect traction at all times. Tractor is pivotally mounted to insure complete flexibility and freedom when passing over uneven ground.

This type of Motor Grader is rapidly winning approval wherever roads are being built.

BANK CUTTING TYPE LEANING WHEEL GRADERS

As shown by the illustration at the right, the extreme adjustment of the Galion Bank Cutting Leaning Wheel Grader permits reaching an angle of approximately 30 degrees off the perpendicular, with wheels on the level, thus giving a wide range of blade adjustment for cutting down banks.

The blade can be extended well outside the line of wheels so that shoulders can be finished without getting grader off the pavement. These adjustments are quickly and easily made.

STONE SPREADERS FOR ROAD WIDENING

The new type of Galion Stone Spreader (patent pending) was especially designed for widening roads. Spreader is attached to rear end of truck and is carried on runners. It spreads stone neatly and uniformly—exactly where you want it—without truck leaving road.

Bottom of spreader is inclined toward the widening trench—opening is adjusted to the width of trench to be filled with stone (see illustration at right).

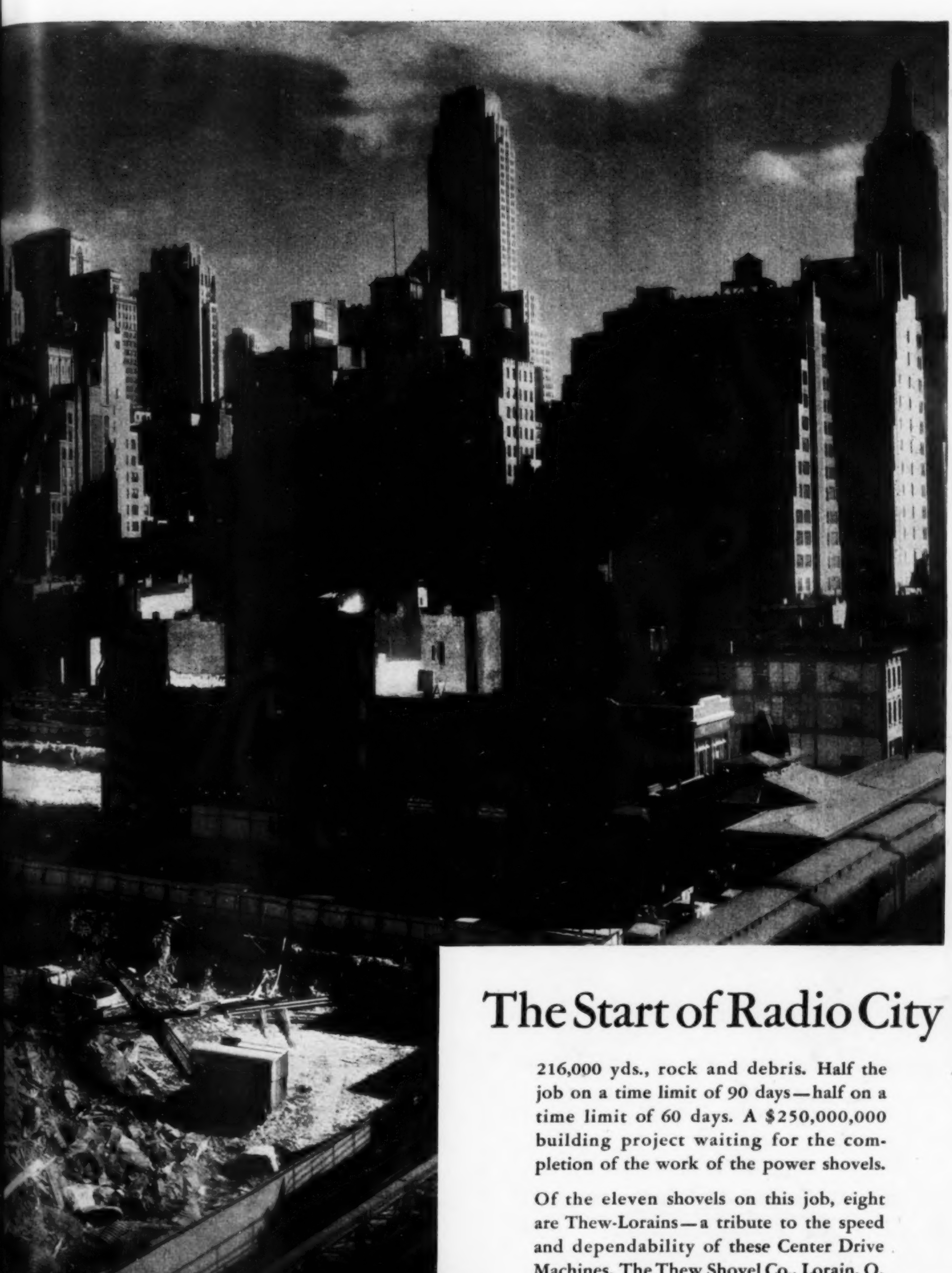
Complete details on any or all of these Galion developments will be sent on request.

The Galion Iron Works & Mfg. Co.
GALION . . OHIO

GALION DISTRIBUTORS

ALABAMA, Birmingham—G. C. Phillips Trac. Co., Inc.
ARIZONA, Tucson—Ronstadt Hdwe. & Mchy. Co.
ARKANSAS, Little Rock—Murphy & Murphy.
CALIFORNIA, Los Angeles—Smith-Booth-Usher Co.
San Francisco—Jenison Machinery Co.
CANADA, Montreal—Jeffrey Mfg. Co., Ltd.
Vancouver—Brown Fraser & Co., Ltd.
COLORADO, Denver—H. W. Moore Equipment Co.
CONNECTICUT, New Haven—Power Equip. & Service Co.
GEORGIA, Atlanta—R. S. Armstrong & Bros.
ILLINOIS, Rockford—Standard Road Equipment Co.
Peoria—The A. E. Hudson Co.
Springfield—Miller & Requarth.
IOWA, Des Moines—Dukehart Machinery Co.
KANSAS, LaCrosse—F. E. Vaughn.
Salina—Salina Trac. & Thresher Co.
KENTUCKY, Frankfort—Frankfort Equipment Co.
LOUISIANA, New Orleans—Louisiana Rd. Mchy. Co.
MAINE, Portland—Eastern Tractor Co.
MASSACHUSETTS, Cambridge—Eastern Tractor Co
MICHIGAN, Lansing—Hubbard Equipment Co.
MINNESOTA, St. Paul—Borchert-Ingersoll, Inc.
MISSOURI, St. Louis—O. B. Avery Co.
Springfield—R. L. McDonald Equip. Co.
MONTANA, Butte—Hall Perry Machinery Co.
NEBRASKA, Omaha—Interstate Mchy. & Supply Co.
NEW MEXICO, Albuquerque—Morrow Auto Co.
NEW YORK, New York—Good Roads Mchy. Co. of N. Y., Inc.
Penn Yan—W. H. Stoutenburg
NORTH CAROLINA, Asheville—Asheville Sup. & Fdry. Co.
Raleigh—N. Car. Equip. Co.
NORTH DAKOTA, Fargo—Lewis Tractor & Mchy. Co.
OKLAHOMA, Enid—Bert Smith.
Oklahoma City—Herd Equip. Co.
OREGON, Portland—Feenaughty Machinery Co.
TENNESSEE, Memphis—W. D. Banker Road Mchy. Co.
Nashville—Tennessee Tractor Co.
TEXAS, San Antonio—Lewis-Patten Co.
Houston—The R. B. Everett Co
UTAH, Salt Lake City—C. H. Jones Co.
VIRGINIA, Richmond—Richmond Mchy. & Equip. Co.
WEST VIRGINIA, Huntington—Banks Miller Sup. Co.
Welch—Welch Good Rds. Sup. Co.
WISCONSIN, Milwaukee—Badger Trac. & Equip. Co

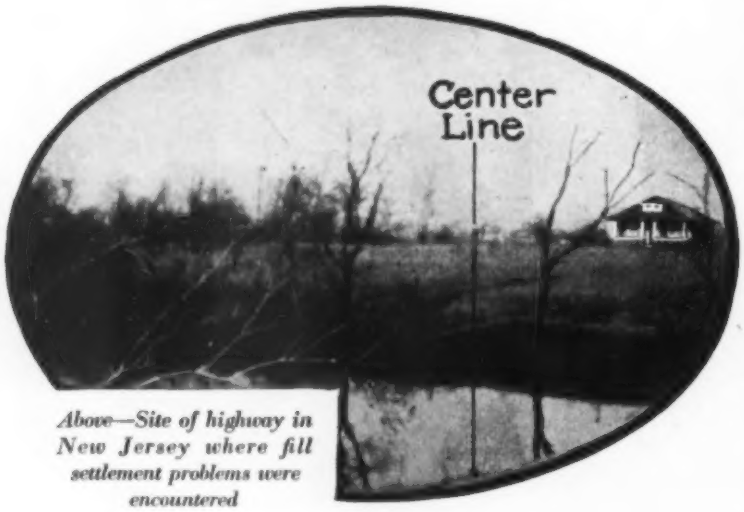

©TECHNI-PHOTO, N.Y.C.



Through muck

DYNAMITE'S

job is displacing soft way Fills to make



Above—Site of highway in New Jersey where fill settlement problems were encountered

DYNAMITE has found a new job. Today, on thousands of miles of highways, it is helping to simplify one of the most difficult tasks highway construction engineers have to encounter—building roads across swamps and marshes.

Unless the full degree of settlement is attained through the underlying strata of peat or muck, road surfaces soon become uneven, attended by displacement of pavement. This results in exorbitant maintenance costs and makes the road unsafe for travel.

Blasting the unstable underlying material with explosives proves successful in accelerating the settlement of the fill so as to secure permanent roadways. Dynamite dislodges the mud, peat or other material efficiently and quickly. The methods of using dynamite are variable and can be applied in almost any locality. Here are three methods that have been successfully used:

1. The first method is to blast with du Pont Ditching Dynamite as large a ditch as possible along the center line of the projected highway. Such a ditch may be thirty feet wide and eight feet deep. The

Above— Section of highway after dynamiting settled the fill

•

Right—Same as section above but with pavement completed and subjected to heavy traffic for a period of one year with no appreciable settlement

E. I. DU PONT DE NEMOURS & COMPANY, INC.

to hard bottom

new and successful material below High-permanent roads• • •

fill is then put in the ditch and piled up in sufficient quantity as to cause a considerable natural settlement, due to its weight, through the remaining unstable material. Blasting a ditch has two functions, first to throw out as much material as possible and second to liquefy or stir up the remaining material so that it can be readily pushed aside by the weight of the fill.

2. The second method is to place the required fill on the top of the marsh and load the dynamite in the mud or muck beneath the fill. Because of the water content of the underlying material, du Pont 60% Gelatin is recommended for this work. The force of the explosion pushes the muck aside and the fill settles in place. Here again the dynamite has two functions, first to create a cavity for the fill to drop into, and second to semi-liquefy the remaining muck.

3. The third method is to use du Pont Ditching Dynamite to shoot ditches on either side of the new fill after it has been put in place, in order to relieve the pressure so that the weight of the fill can more easily push out the underlying mud. When the muck is deep, the ditches are not sufficient and extra loads of du Pont Ditching Dynamite are placed in the ditch line at a depth below the bottom of the fill, so that the resulting explosion will force the remaining material out on either side of the fill. This method particularly applies when the fill material is clay and, therefore, will not flow readily.

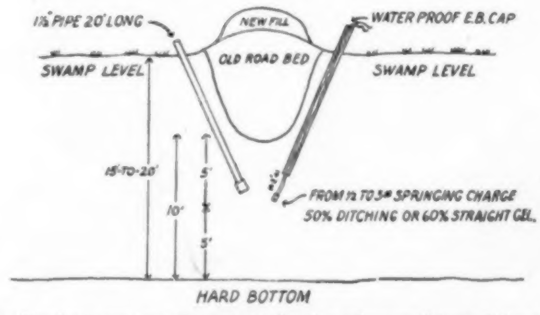
These three methods may be combined or suitably varied to meet any local condition or problem.

Our explosives engineers are observing and reporting on fill settlement projects in many sections of the country. Their findings are available to engineers, contractors and officials engaged in constructing and maintaining highways. Your inquiries and problems are invited in the interest of better highways, lower maintenance costs and public satisfaction.

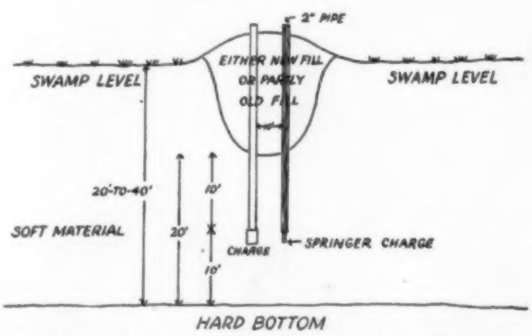
DU PONT

REG. U. S. PAT. OFF.

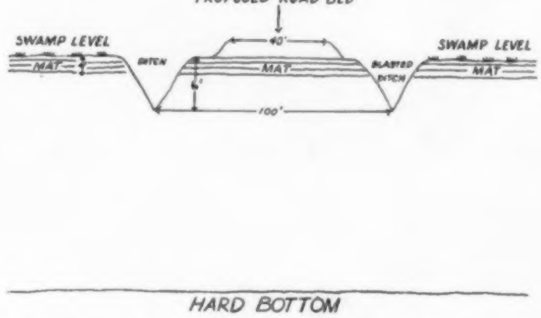
Some methods of loading for Fill Settlement blasts in the Lake States Area



1. *Simplest in swamp not over twenty feet deep where conditions will furnish a twenty-foot length of pipe to be forced or driven by hand. Requires no other equipment than hammers, pipe-cutter and other small hand tools.*



2. *The method used in swamps deeper than twenty feet. Requires power-driving equipment.*



3. *For new work, the idea being to cut the mat and relieve side pressure to give fill better chance to settle, and settle straight. Next step is to blast underneath fill after fill has ceased to settle.*

Explosives Department • Wilmington, Del.

Earning ability!

THAT'S THE FINAL TEST OF TRUCK VALUE

After all, the final test of a truck's value is its earning ability. Dodge Trucks not only earn—they earn more, for several very definite reasons. » » Typical of Dodge value is the Standard 1½-ton chassis. Its price—only $595 f. o. b. Detroit—calls for but a small investment. Then, because of this truck's many exceptional features, you get greater dependability, ample power, ease of control, speed, safety, economy and long life—all an assurance of maximum earning ability. » » Inspect and test this 1½-ton truck or any of the many other Standard or Heavy-Duty types in the Dodge line. You will find that the experience gained in building over 400,000 quality Dodge Trucks assures you a truck that is precision-built and perfectly balanced part-to-part—a truck that will work and earn for you every mile of its long life.

PAYLOAD CAPACITIES IN THE HEAVY-DUTY LINE RANGE FROM 3,600 TO 11,175 POUNDS—AND UP, FOR TRACTOR AND TRAILER SERVICE. PRICES ARE EXCEPTIONALLY LOW. » » THE STANDARD LINE RANGES IN PAYLOAD CAPACITY FROM 1,200 TO 4,300 POUNDS AND INCLUDES THE 1½-TON CHASSIS AT . . . . $595 F. O. B. DETROIT

TO HELP LOWER YOUR HAULING COSTS OPERATING RECORD BOOK FREE

DODGE BROTHERS CORPORATION E-8
Detroit, Michigan

Send your Operating Record Book. I understand there is no obligation.

NAME__________

ADDRESS__________

CITY__________ STATE__________

Number of Trucks Operated (*Book for each will be sent*)__________

DEPENDABLE

DODGE TRUCKS

BEARINGS

Drum shaft and countershaft: double row, self-aligning, shaper roller bearings—two to each drum.

Drum: Large Hyatt Roller Bearings.

Thrust Bearing: Timken Tapered Roller Bearing.

BRAKES

Brakes on opposite end of drum frictions; eliminating heat. 35" diameter, 4" width with 280° contact, providing sure braking on maximum loads and speeds.

FRICTIONS

Blocks of asbestos, graphite molded, give 680 square inches of friction area per drum. This great area plus proper block angle plus Timken Roller Thrust Bearing give new, easy control of loads.

DRIVE

Power is transmitted by a quadruple, roller bearing chain running in a sheet steel case.

FRAME

Welded Unit, Steel Frame.

Base: Heavy I-beam sections with large diameter, patented tubular spreaders.

Side Frames: T-sections with welded-in channel supports. Side frames are welded integrally with the base. This construction defeats side-frame breakage, weaving and misalignment.

POWER

Overhead valve, gasoline engines or AC or DC Electric motors.

. . .

There are 108 different hoists in the Novo Line: a size and type for every job. This New 100 h. p. Hoist is typical of what you can expect in our entire hoisting line. The line covers hoists for all types of building and construction jobs, big or small, platform elevators, steel construction, concrete bucket work, etc.

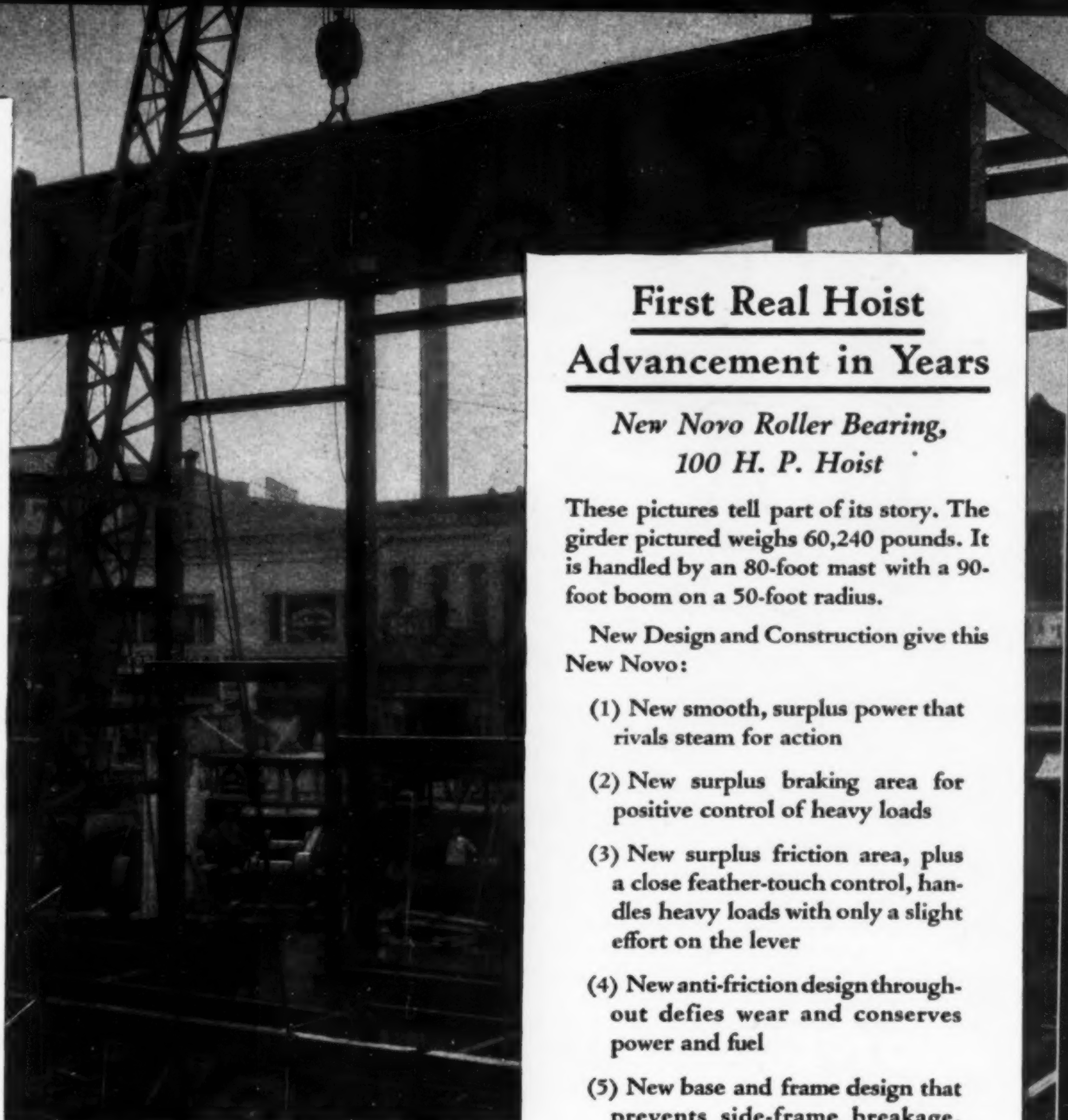
Dragline and Slackline hoists for handling drag-scraper buckets on excavating, grading, moving and storing materials, sand and gravel pit work.

Pile-Driving Hoists for handling pile driving, derrick and clam shell bucket or steel erection on bridge, dam and similar jobs.

So no matter what your requirements:

Come to Hoist Headquarters for performance, for value, for information.

NOVO
Headquarters For Hoists



First Real Hoist Advancement in Years

New Novo Roller Bearing, 100 H. P. Hoist

These pictures tell part of its story. The girder pictured weighs 60,240 pounds. It is handled by an 80-foot mast with a 90-foot boom on a 50-foot radius.

New Design and Construction give this New Novo:

(1) New smooth, surplus power that rivals steam for action

(2) New surplus braking area for positive control of heavy loads

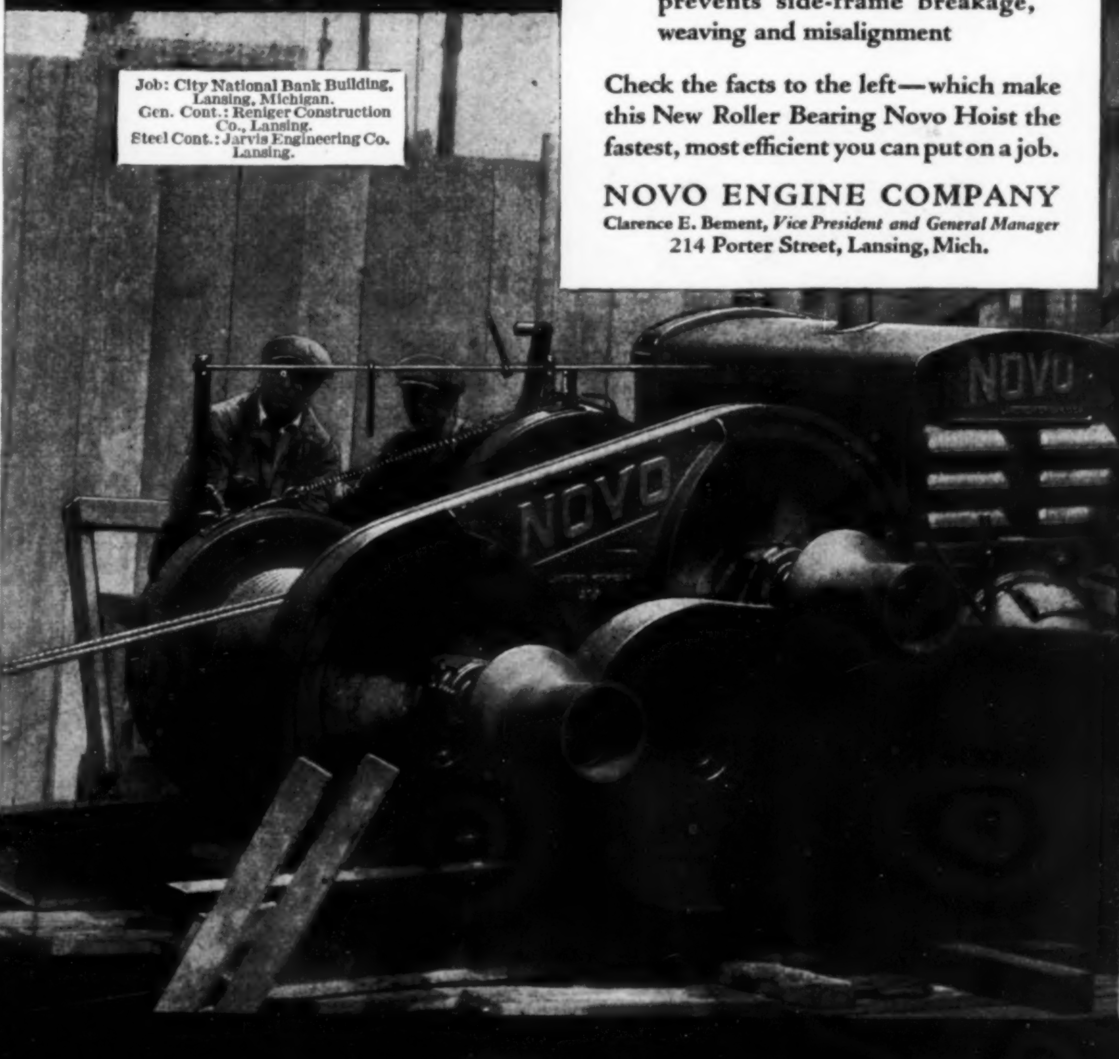
(3) New surplus friction area, plus a close feather-touch control, handles heavy loads with only a slight effort on the lever

(4) New anti-friction design throughout defies wear and conserves power and fuel

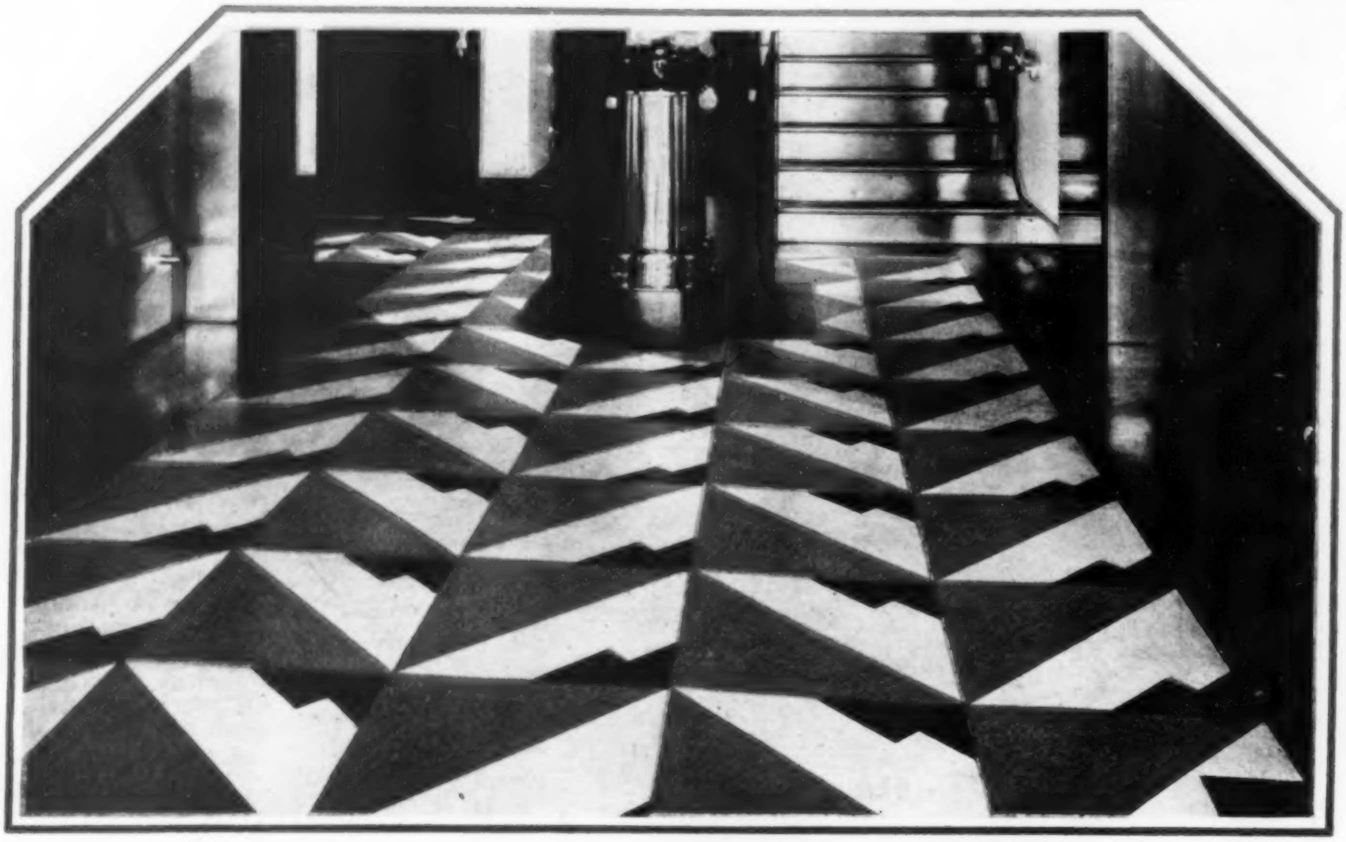
(5) New base and frame design that prevents side-frame breakage, weaving and misalignment

Check the facts to the left—which make this New Roller Bearing Novo Hoist the fastest, most efficient you can put on a job.

NOVO ENGINE COMPANY
Clarence E. Bement, *Vice President and General Manager*
214 Porter Street, Lansing, Mich.



Job: City National Bank Building, Lansing, Michigan.
Gen. Cont.: Reniger Construction Co., Lansing.
Steel Cont.: Jarvis Engineering Co. Lansing.



A true-color reproduction of the terrazzo floor in the lobby of the Cinderella Bldg., St. Paul. Artcraft Mosaic Co., St. Paul, used Atlas White portland cement for the terrazzo.

Terrazzo made with Atlas White insures colorful, durable floors

IN designing the colorful terrazzo floors now so much in vogue, marble chips of many shades and hues are used. To bring out and preserve the true color value of these chips, a pure white or lightly-tinted background is essential. Atlas White, a pure white portland cement, furnishes an ideal background for white, black or colored marble chips. It is used from coast to coast for fine terrazzo.

Name ....

Address ....

UNIVERSAL ATLAS CEMENT CO.
208 S. LaSalle St., Chicago
Without obligation, please send me further information on Atlas White terrazzo.
C.M. 9-31

59

CONCRETE FOR PERMANENCE

Universal Atlas Cement Co.

Subsidiary of United States Steel Corporation

ATLAS WHITE PORTLAND CEMENT

CHICAGO · NEW YORK · PITTSBURGH · MINNEAPOLIS · KANSAS CITY

© U. A. C. Co.

Construction Methods

A McGraw-Hill Publication—Established 1919

ROBERT K. TOMLIN, *Editor*

Volume 13 NEW YORK, SEPTEMBER, 1931 Number 9

Double-Chambered STEAM VACUUM PUMP *Handles Dredged Spoil*

AN 8-IN. Pulsometer steam pump is disposing of 40,000 yd. of mud dredged with clamshell bucket to deepen the channels of a lake at Millerton, N. Y. Courtney Campbell of New York City is the contractor. A $\frac{3}{4}$-yd. bucket, operated by a gasoline crane mounted on a float made of gasoline barrels, digs the mud and loads it into 60-yd. scows. The scows are taken by a motor launch to the shore of the lake, where the Pulsometer, supported on a similar float, pumps the material from the scows to the discharge pool, which is dammed by earth dikes.

A small gasoline centrifugal pump supplies water to two pressure jets used to break up large clods in the scow. Because the Pulsometer unloads faster than scows can be loaded and moved alongside, it actually operates only about five hours during each ten-hour day, pumping out eleven or twelve 60-yd. loads at a total labor-and-fuel cost of approximately 4.5c. per yard. The pump will finish the job in two months. Although the boiler used, 125-hp., is almost twice the size, 70-hp., required for the pump, the total expense of equipment and labor of installation (including first cost of pump and spare parts, making floats, trucking, boiler rental, and work on dikes) amounts to less than $3,000. Mr. Campbell claims that the Pulsometer is cheaper and faster than any other means he has used to handle or pump dredged material.

CONTINUOUS STREAM ***(above, left)*** **containing up to 35 per cent solids flows from 7½-in. discharge pipe. STEAM VACUUM PUMP** ***(above)*****, resting on float, unloads 60-yd. scow in 20 min. Pressure jets from small centrifugal pump adds water to mud. Sticks and stones do not clog pump or cause it to lose prime.**

COAL CONSUMPTION is ½-ton per day to pump 720 yd. Pump operates half time during 10-hour day. Boiler is almost double size required.

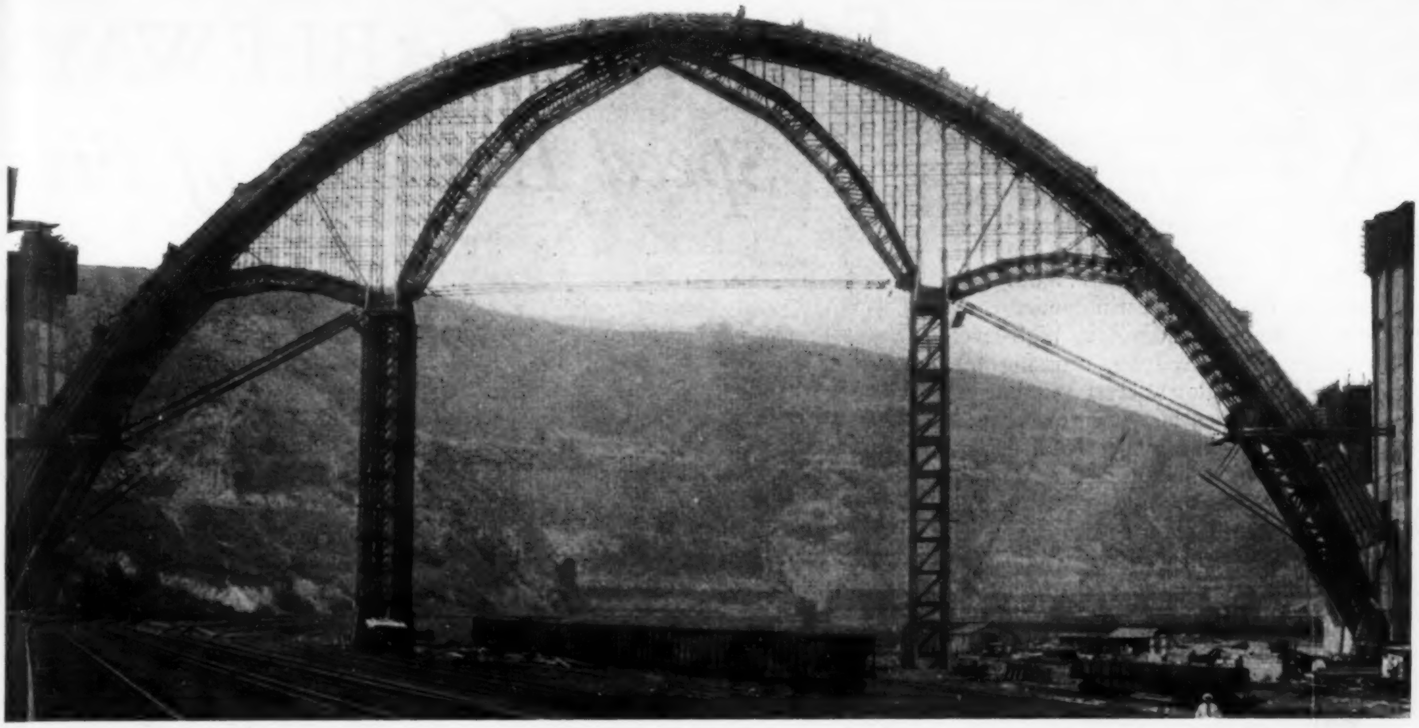
This Month's "News Reel"

Acme

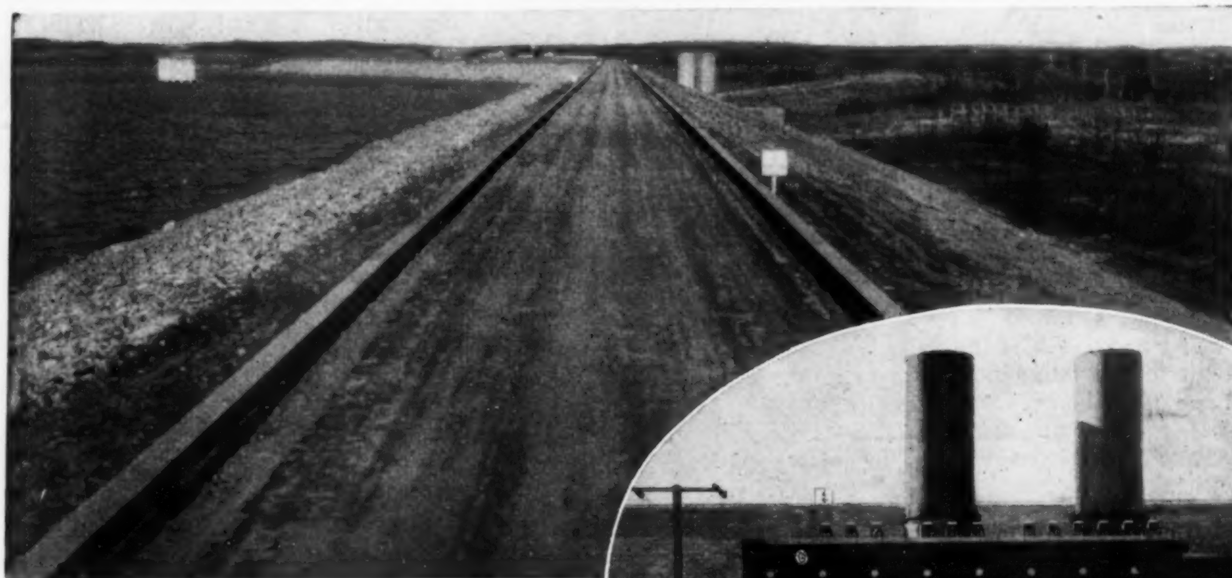
TRACK-LAYING RIG extends line of Great Northern Railroad into California for first time, connecting San Francisco directly with northern tier of states between the Great Lakes and the Pacific Coast. Machine, placing 2 miles of track daily, has mechanical carriers for ties and rails. Spikes are driven with pneumatic hammers.

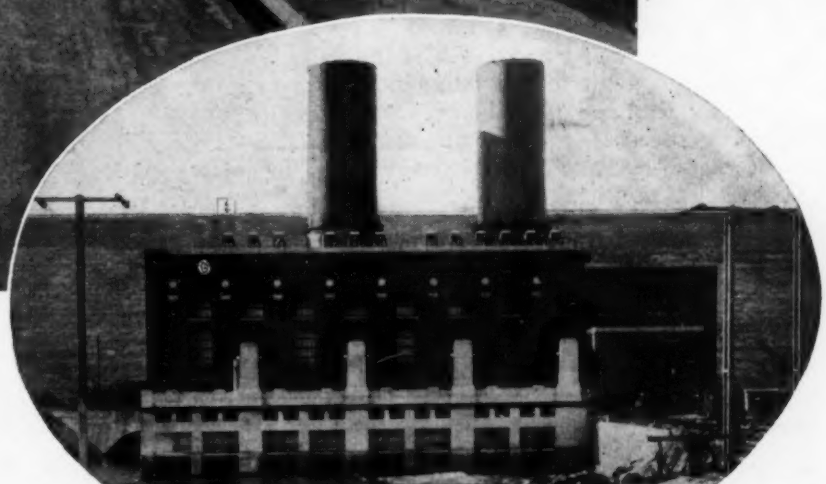
CONTRACTORS' LICENSE BILL *(right)* signed by Governor Rolph of California. To the left of the Governor is W. J. Wilkinson, president, California Chapter, Associated General Contractors of America; at the right are Carlos W. Huntington, registrar of contractors and Adolph Teichert, Jr., president, Northern California Chapter of the A.G.C.

MOST BEAUTIFUL SMALL BRIDGE erected during 1930. Delton steel arch highway bridge in Sauk County, Wisconsin, costing $54,000, receives award by American Institute of Steel Construction. Structure was designed by Wisconsin Highway Commission and fabricated by Lakeside Bridge & Steel Co. Arch spans are each 218 ft. long.



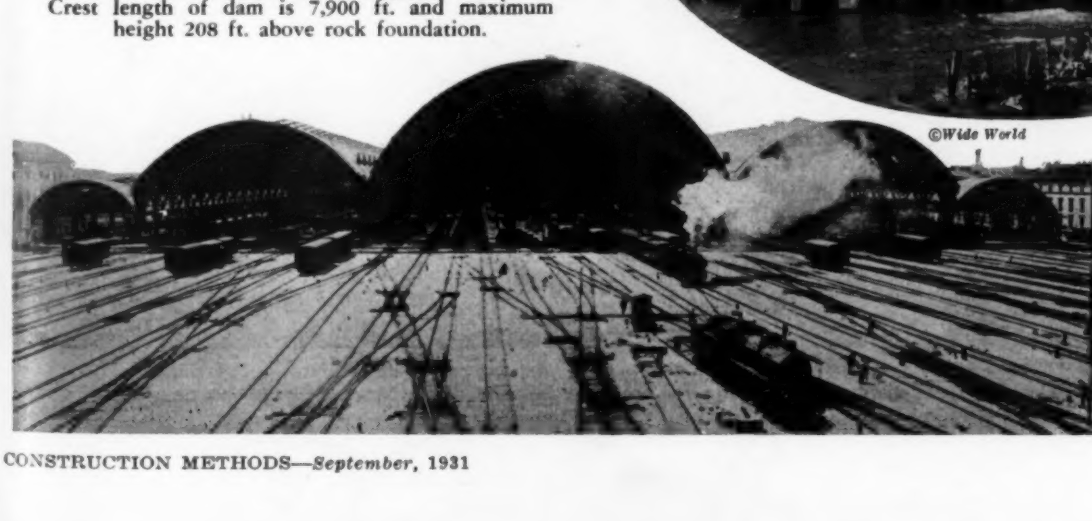
STEEL CENTERING in place for concreting the main arch, with a span of 460 ft. between pier centers, of the George Westinghouse bridge at East Pittsburgh, Pa., described in detail elsewhere in this issue of *Construction Methods.* Three-track tower cableway with span of 1,650 ft. handles concrete forms and centering for five-arch bridge 1,500 ft. long.





SALUDA DAM AND POWER HOUSE *(above and at right)* are completed and in service near Columbus, S. C. Hydro-electric project costing $22,000,000, built by W. S. Barstow & Co., Inc., with Arundel Corp. as sub-contractor, includes dam containing 11,000,000 cu.yd. of earth fill, largest in world built for power development purposes. Crest length of dam is 7,900 ft. and maximum height 208 ft. above rock foundation.

©Wide World



NEW RAILWAY TERMINAL *(left)* is completed at Milan, Italy. Central station has series of five arched-roof trainsheds providing modern transportation gateway to industrial Italy.

TOWER CABLEWAYS

Speed Building of Five-
With 460-Ft.

A THREE-TRACK tower-cableway system, steel arch centers, and a central mixing plant are the principal items of equipment being used by the Booth & Flinn Co., of Pittsburgh, contractor, to build the five-arch George Westinghouse concrete highway bridge, a high-level structure 1,500 ft. long, crossing the Turtle Creek valley at East Pittsburgh, Pa. The main span, 460 ft. between pier centers, is the longest reinforced-concrete arch to be constructed in this country. A well-planned schedule for progressive utilization of the centering has enabled the contractor to pour the ten ribs of the five spans in rapid sequence. Concreting of the first rib began Jan. 30, 1931, and the tenth rib was completed Aug. 29, 1931.

The bridge is the outstanding feature of a much-needed Lincoln highway relocation, originally proposed by the Pennsylvania department of highways. The cost of the bridge is being shared equally by the state and Allegheny County. The bureau of bridges of the Allegheny County department of public works designed the structure and is supervising its construction.

Bridge Design—Local conditions determined the choice of a five-span bridge. The design was made as symmetrical as possible about the central arch, with intermediate spans of 295 ft. each and abutment spans 196.33 ft. long at the east end and 277.5 ft. at the west. A fault in the foundation rock at the west end of the bridge compelled the engineers to locate this abutment some distance back from the symmetrical position.

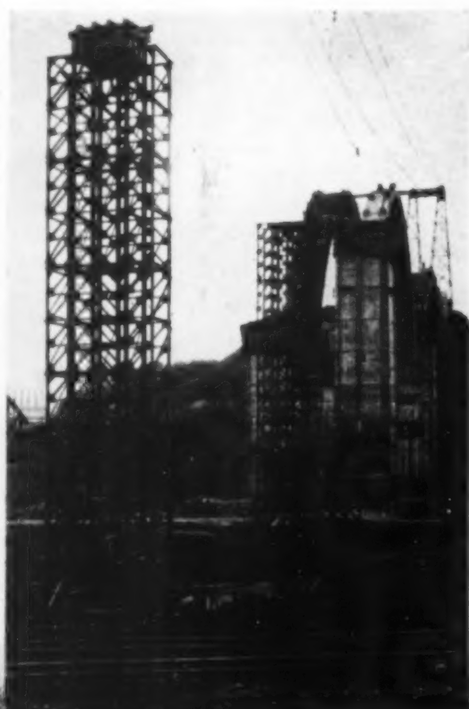
All piers and abutments rest on sandstone rock except Pier 1, which is founded on hard shale. Foundations of Piers 2 and 3, supporting the main arch, are 42 ft. long by 50 ft. wide, from bedrock to a point about 15 ft. below the ground surface, where they widen out to 74 ft. The design of the other two piers is similar, with the exception that the dimension longitudinally with the bridge is shortened.

From just above the ground surface to the top of the upper skewback, the piers are solid except for a central well, 15 ft. wide, transverse to the bridge, and, in the main piers, about 30 ft. long. The outside transverse walls tie together the two solid masses separated by the central well. Above the upper skewback, the piers are cellular, with reinforced-concrete walls forming the sides of the shaft. The walls are vertical on the inside and are battered $\frac{3}{16}$ in. in 12 in. on the outside, reducing to a minimum thickness of 18 in. at the roadway. This batter gives a maximum thickness at top of foundation of about 5 ft. The shaft walls are stiffened by pilasters on the four sides of the pier.

The bridge roadway will be 42 ft. wide, providing for four lanes of traffic between curbs. Two 7-ft. sidewalks are carried on cantilever brackets. The roadway rises on a 4 per cent grade from west to east.

All arches consist of two ribs 14 ft. wide spaced on 32-ft. centers. For the central arch, with a high rise of 158 ft. and a span of 411.52 ft., springing line to springing line, the ribs were designed 5 ft. deep at the crown and 10 ft. at the spring line.

Reinforcing in each main-span rib consists of 34 $1\frac{1}{4}$-in. square bars, equally divided between top and bot-



ARCH RIB CONSTRUCTION starts at Span 1. Workmen are preparing to pour crown segments of south rib, Span 1. Cableway is erecting hinged closing section of steel centering for north rib, Span. 2. Steel towers *(above)* to carry main-span centering.

AND STEEL CENTERS

Arch Concrete Bridge

Central Span

tom. On all other spans, each rib is reinforced with 28 1¼-in. square bars, likewise equally divided between top and bottom. Light structural-steel cross-frames about 15 ft. apart supported the bars on the concrete form, the bars being fastened to the frames with hook bolts.

The columns of each structural bent supporting the deck consist of pairs of shafts, one pair on each arch rib. The distance center to center of columns was selected to balance as nearly as possible the dead loads from the floor beams and projecting sidewalk brackets. Inside shafts of the bent are 20 ft., c. to c., and outside shafts are 34 ft., c. to c. All shafts have a width transverse to the bridge of 2 ft., except the end columns of the main span, which are 2½ ft. wide. The dimension longitudinally with the bridge varies from 4½ ft. for the longest columns to 2½ ft. for the shortest.

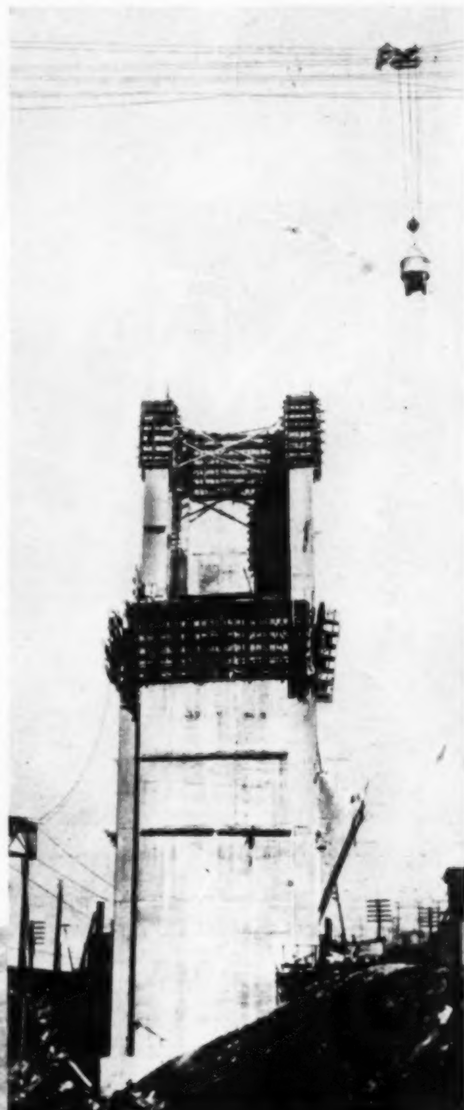
The two shafts of each column are connected at the top by a heavy diaphragm under the floor beam, and the longer columns are tied together by intermediate struts spaced a maximum clear distance of 30 ft. apart.

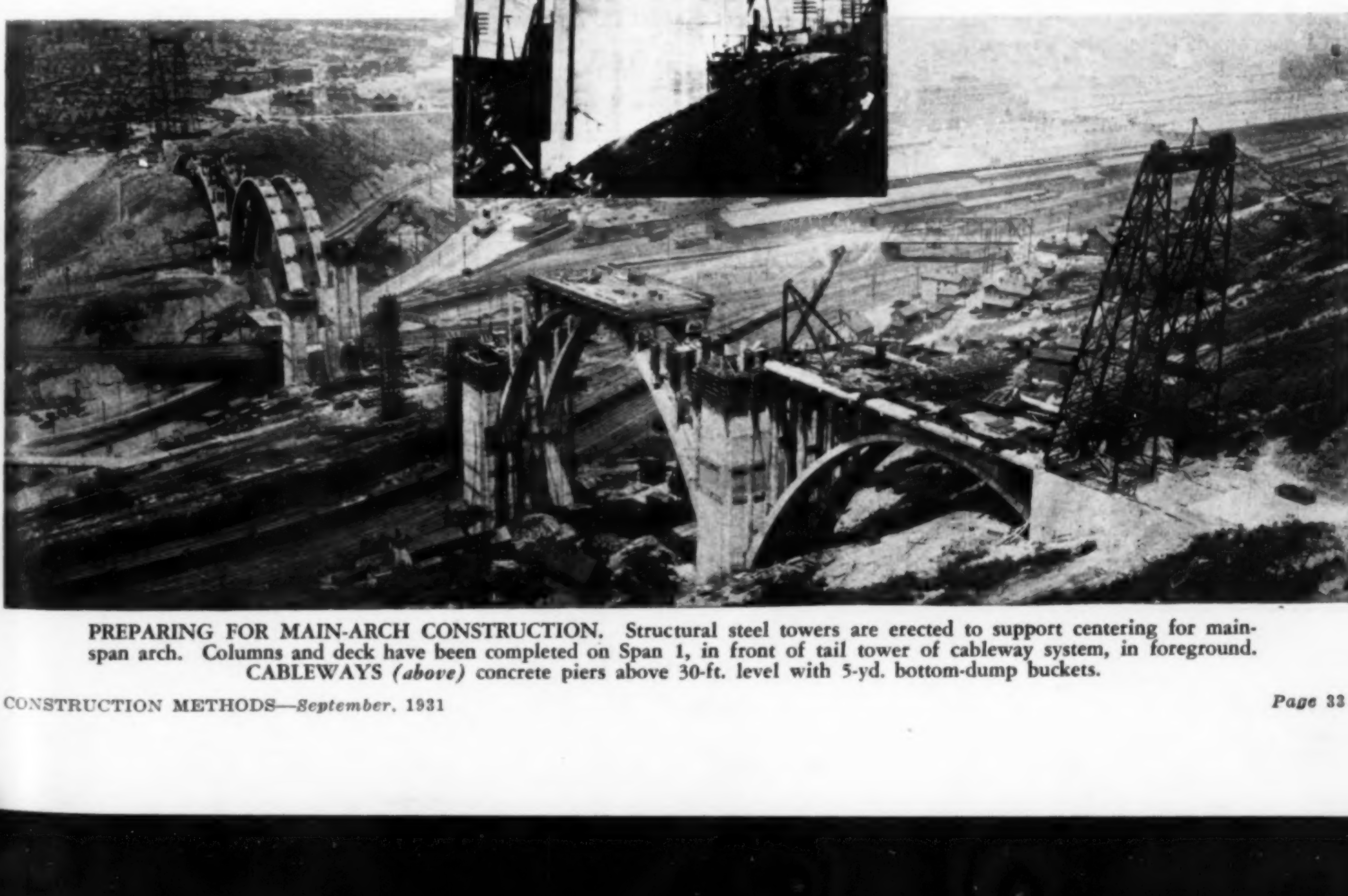
Pier Construction—All piers were constructed simultaneously. Rock foundation under the abutments was uncovered a short distance below ground surface. Pier 1 was carried 50 ft. to red shale and Pier 4, 35 ft. to sandstone, by open excavation. Reinforced concrete caissons were sunk 90 ft. at Pier 2 and 55 ft. at Pier 3. It had been expected that compressed air would be needed in the caissons; but both piers were unwatered by pumps without difficulty, and foundations were poured in the dry. Total excavation for the foundations amounted to 24,000 yd.

Cranes and stiffleg derricks, excavated the piers with clamshells and concreted them by bucket. At Piers 2 and 3, steel stifflegs with 90-ft. booms, powered by steam hoists, were used to reach all parts of the caissons from one set-up of the mixer. A P&H gasoline crane with an 80-ft. boom and a Thew gasoline machine with a 60-ft. boom operated at the other two piers.

A Ransome 27-E paver, batched by trucks, mixed the concrete at each pier, being moved from one pier to another in accordance with the construction schedule. The cranes and derricks carried the concreting of the piers to an elevation about 30 ft. above the ground, pouring about 32,000 yd. in all.

As the east abutment offered the most desirable location for the tail tower of the cableway system, it was





PREPARING FOR MAIN-ARCH CONSTRUCTION. Structural steel towers are erected to support centering for main-span arch. Columns and deck have been completed on Span 1, in front of tail tower of cableway system, in foreground. CABLEWAYS *(above)* concrete piers above 30-ft. level with 5-yd. bottom-dump buckets.

CABLEWAY ERECTS CLOSING SECTION of steel centering for north rib, Arch 4.

MAIN-SPAN CENTERING almost completed for north rib. Timber falsework is erected on steel centers supported by structural towers.

imperative that construction of the abutment be rushed to early completion. Because of the inaccessibility of this abutment (the approach to which required a cut 165 ft. deep) excavation was carried on by hand, and concrete was chuted 400 ft. from the top of the hill, 190 ft. above the bridge deck, where trucks could deliver batched materials to the mixer. The 400-ft. chute line, equipped with two intermediate control hoppers, delivered concrete to a 2-yd. receiving hopper. Hand buggies wheeled the concrete from this hopper to the forms.

Tower Cableways—For a high-level concrete bridge on which steel centers are used, a tower-cableway is the logical means of handling materials. The cableway system for the Westinghouse bridge comprises two tracks over the north ribs, where the steel centers are erected, and one track over the south ribs. Erection of the cableway towers was started as soon as pier construction had advanced a short distance above ground. Each of the two towers is designed for a load of 50 tons on the north side, 25 tons on the south, and 28 tons in the center, the last providing for a track along the center line of the bridge if the contractor should desire to use one on the work.

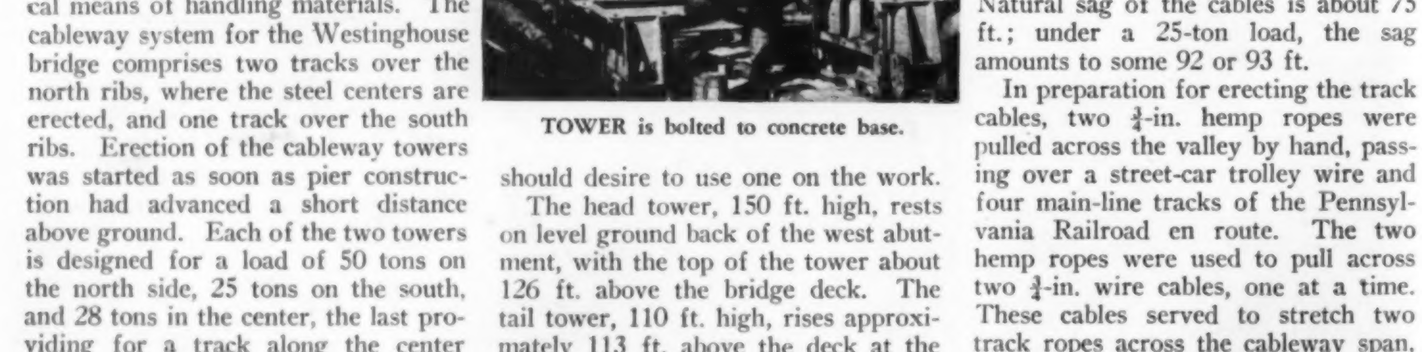
TOWER is bolted to concrete base.

The head tower, 150 ft. high, rests on level ground back of the west abutment, with the top of the tower about 126 ft. above the bridge deck. The tail tower, 110 ft. high, rises approximately 113 ft. above the deck at the east abutment.

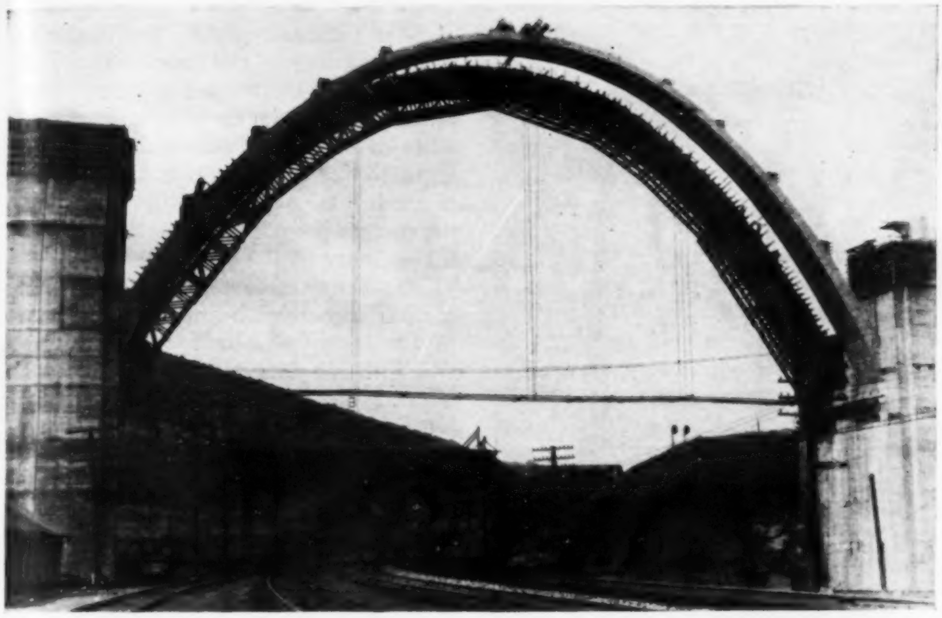
A. J. Eldridge, of Columbus, Ohio, designed the tower-cableways and aided in supervising their erection. Each tramway is equipped with Lidgerwood trolley carriers and is operated by a Lidgerwood steam hoist, with a 12x12-in. load drum and a narrow endless cable drum, both of which give a single line speed of more than 2,500 ft. per minute. The hoisting block of the five-part load line has a speed of over 500 ft. per minute. All cables are Leschen Red Strand wire rope. The two track cables over the north rib are $2\frac{1}{4}$-in. rope, and the south track cables are $2\frac{1}{2}$-in. Lead lines and endless hauling ropes are $\frac{3}{4}$-in.

The cableway span is 1,650 ft. Natural sag of the cables is about 75 ft.; under a 25-ton load, the sag amounts to some 92 or 93 ft.

In preparation for erecting the track cables, two $\frac{3}{4}$-in. hemp ropes were pulled across the valley by hand, passing over a street-car trolley wire and four main-line tracks of the Pennsylvania Railroad en route. The two hemp ropes were used to pull across two $\frac{3}{4}$-in. wire cables, one at a time. These cables served to stretch two track ropes across the cableway span, one over the north rib and the other



NORTH ELEVATION of George Westinghouse bridge. Numbers under centers indicate sequence of erection for steel arch centering on Spans 1, 2, 4 and 5. System of tiebacks for centering on Spans 2 and 5 is shown. Ties for Spans 1 and 4 are similar to those shown.



TRUSSED FLAT ROOF under Span 4 protects main-line tracks of Pennsylvania Railroad from danger of falling objects.

over the south. The north track cable erected the second track rope on the same side of the bridge.

The south cableway was erected on the center line of the south rib; the north cableways were located 3 ft. apart, each of them being 1½ ft. off center line.

Steel Centering—Steel for the Blaw-Knox centering was brought in from the Ohio River boulevard, where it had previously been used on five concrete arch bridges, as described in *Construction Methods,* Feb., 1931, pp. 40-41. The steel was bolted into units under Arch 2, on the only ground available for assembly work.

As all the piers were designed to be stable under unbalanced arch thrust, it would have been possible to erect the ribs in any order. The contractor, however, determined to construct the abutment arches first, to use them as tiebacks for the centering under the intermediate arches. For the same reason, it was desirable to pour the intermediate arches before erecting the centering for the central span.

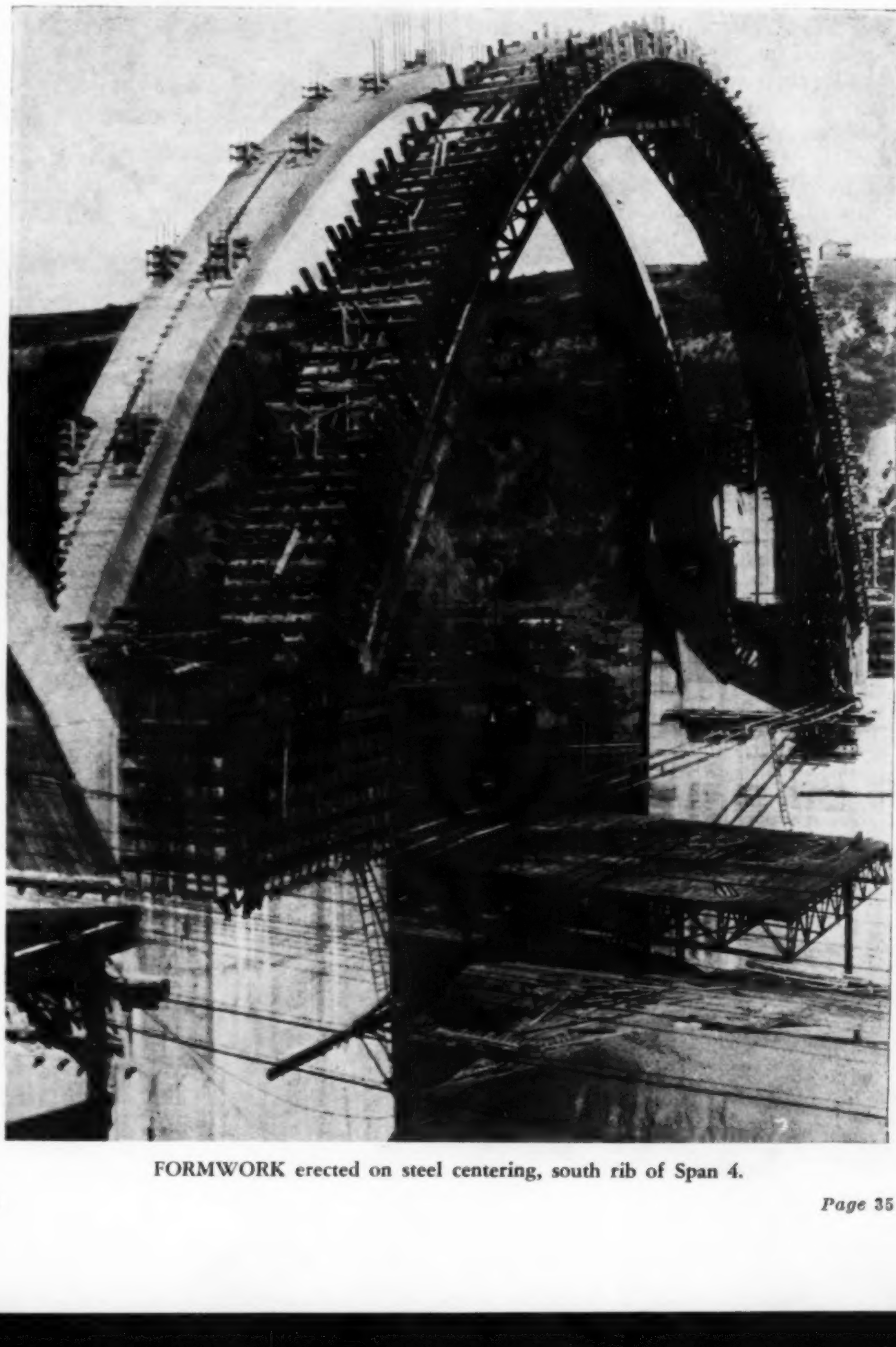
Sufficient centering was available to support one abutment arch rib and one intermediate arch rib. Because of its proximity to the assembly ground, the contractor decided to erect Arch 1 first. This decision, together with the considerations already mentioned, determined that the sequence of operation should be: Span 1, Span 2, Span 5, Span 4, and, last, Span 3.

Centering for each arch was erected by the cableways on the north side. After concrete in this rib had cured sufficiently, the centering was moved to the south rib.

Centers for Arches 1 and 5 consisted of six light, parallel trusses, erected in four units designed to give a maximum single cableway load of 20 tons. In starting erection of Arch 1, the haunch section at the abutment was supported on a temporary timber bent. To reduce the load on the cableway at this point, close to the tail tower, the contractor used a tractor on the ground which helped to pull the haunch section up the slope.

The second unit of Arch 1 centering was erected by the cableways on the haunch section and was tied back to the tail tower. In the same way, the cableways placed the second haunch section and the hinged closing section, which were tied back to Piers 1 and 2, respectively. The accompanying sketch indicates the order of erection and the system of tiebacks.

Erection of Arch 5 followed the same plan as Arch 1, except that five centering units were needed to provide for the longer span. On both Arch 1 and Arch 5 the full six trusses were erected as a unit in the haunch sections; but only three trusses were



FORMWORK erected on steel centering, south rib of Span 4.

placed in the first operation of erecting the other units, the remaining steel being filled in later.

Much the same process of partial erection and filling in later was followed on Arches 2 and 4. A distinct set of centering, consisting of three heavier steel trusses, supported the forms on these arches. This centering was erected and tied back in six units, as indicated by the sketch. The cableways placed the haunch sections complete but erected only two trusses of the other units at first, supplying the third truss later. Weight of the steel units varied from 15 to 35 tons.

Both sets of centering, plus additional steel truss units, were needed for the central span. Two structural steel towers on concrete bases, 163 ft. apart, c. to c., supported this combination of centering, which totaled 710 tons in weight. Timber falsework built up on the steel centers carried the rib forms. The sketch illustrates the method of utilizing the short-span centers to support the main-arch forms.

Moving Centers—Arch centers were supported at all piers by structural steel brackets resting on recessed bases formed in the masonry. A reinforced steel channel resting on the two brackets at a pier served as the track for moving the steel center from the north rib to the south. This channel track was perfectly level.

A channel shoe under the end of the centering rested on the track. As illustrated by one of the photographs, the channel forming the shoe was wider than the one serving as a track; the flanges of the shoe were turned down over the track channel. Both track and shoe were greased.

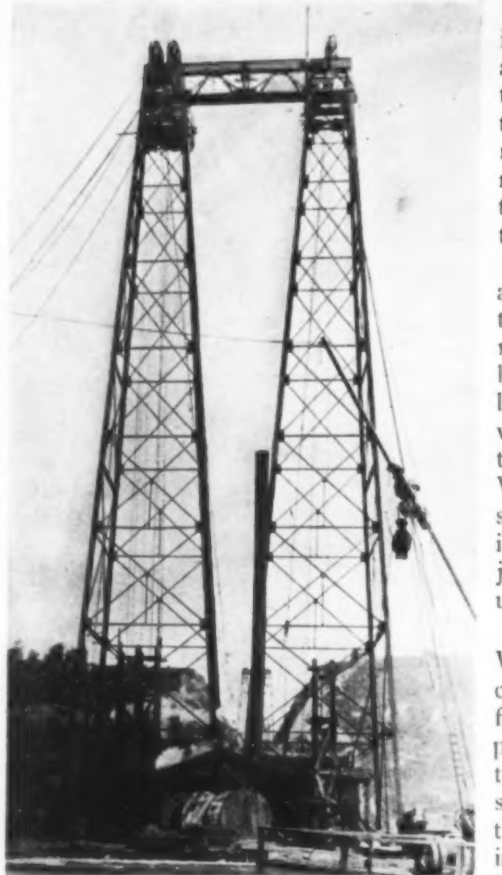
To lower the center for moving, the steel wedges at each haunch were released and, often, the wood wedges were knocked out from under the intrados form to free it from the concrete. A 100-ton Duff ratchet screw jack at each end pushed the center to its new position. The jacks, which had a run-out of 12 in., had to be reset 32 times to move the center the total distance of 32 ft. Considerable time was required for the operation. The force necessary to overcome the inertia of the centers proved to be much less than the capacity of the jacks.

To steady the center during moving, a cantilever steel beam was anchored to the crown of the completed north rib, with the cantilever arm extending beyond the south rib. Two sets of block and tackle, anchored to the beam, were attached to the centering, one on the north side and one on the south. Workmen took up on one set and slacked off on the other as the centering moved. Four 100-ton hydraulic jacks raised the center to position under the south rib.

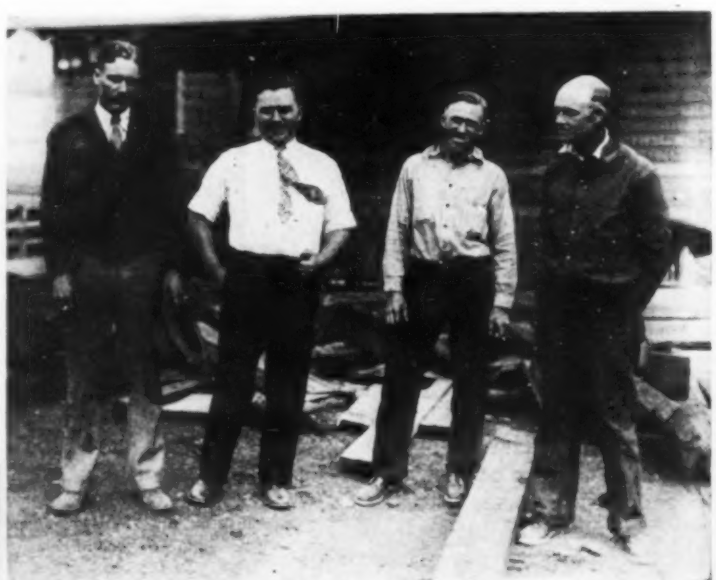
Concrete Forms—All forms on the Westinghouse bridge are of watertight construction, built to satisfy the specifications of George Hockensmith, vice-president and general superintendent of the Booth & Flinn Co. Mr. Hockensmith is a practicing advocate of the theory that disintegration of concrete, in cold climates, is the result of careless formwork.

Forms for piers, arch ribs, and columns were designed for repeated use, with slight modification, on similar parts of the bridge. Panel forms of 2x6-in. tongue-and-groove lumber were used for the full height of the piers, which were poured in 15-ft. lifts. The panels averaged 15 ft. square; but some were as much as 25 ft. wide. Studs of 2x6-in. lumber were spaced about 15 in., c. to c., and double-2x6-in. wales were about 24 in. on centers.

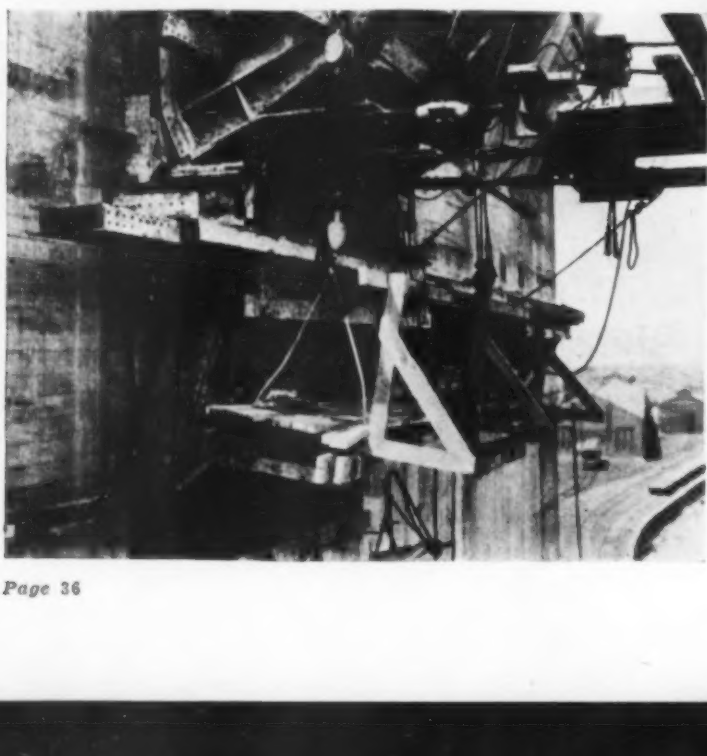
Especially tight forms were used on the arch ribs. The intrados surface form consisted of three-ply ¼-in. ven-



HEAD TOWER of cableway system, with three steam hoist engines at base.



N. H. McLAIN *(left)* superintendent; S. R. HARPER, assistant engineer, in charge of construction; CHARLES E. WHITCOMB, contractor's engineer; and R. A. ALEXANDER, assistant superintendent.



STEEL CHANNEL *(left)* on structural brackets serves as track for moving arch centering from north rib to south. Shoe under centering is wider channel with flanges turned down over track.

eer board on 4x4-in. lagging, spaced 6 in., c. to c. Rib side forms were made of 2-in. tongue-and-groove lumber. All cracks were sealed with a mixture of sawdust and glue, assuring a leakproof form and a dense concrete surface free from pores. High early-strength concrete was used in the ribs, as on the Ohio River Boulevard bridges, to gain earlier removal of the centering.

Form bolts in ribs and columns are $\frac{5}{8}$-in. high-tension steel, instead of ordinary $\frac{3}{4}$-in. steel. Metal sleeves are used on the bolts to permit pulling them entire. To avoid rust streaks on the concrete surface, the sleeves are cut back 2 to 3 in. from the form. The resulting bond with the concrete is not strong enough to prevent pulling the bolts with ordinary rod jacks. Mortar and grout are used to seal the holes.

Forms are made at the job. Both forms and reinforcing steel are assembled in large units before being raised and placed in position by the cableways. The bridge requires a total of 3,500,000 lb. of reinforcing steel.

Concreting—Arch rib forms were bulkheaded into sections, with key blocks 4 ft. long between sections. On the main span, the design provided three keys; but the two closing sections were short enough to act as keys. The sections of each rib were spaced symmetrically with respect to the arch axis, and the segments were poured two at a time.

Ribs of Spans 2 and 4, for example, were each poured in six sections. The procedure in placing concrete on each of these ribs was to pour the two haunch segments first, the crown blocks second, and the intermediate sections last. Concreting of two segments was carried on in alternate steps to keep a nearly balanced load on the centering. Column stubs about $1\frac{1}{2}$ ft. high were poured with the ribs.

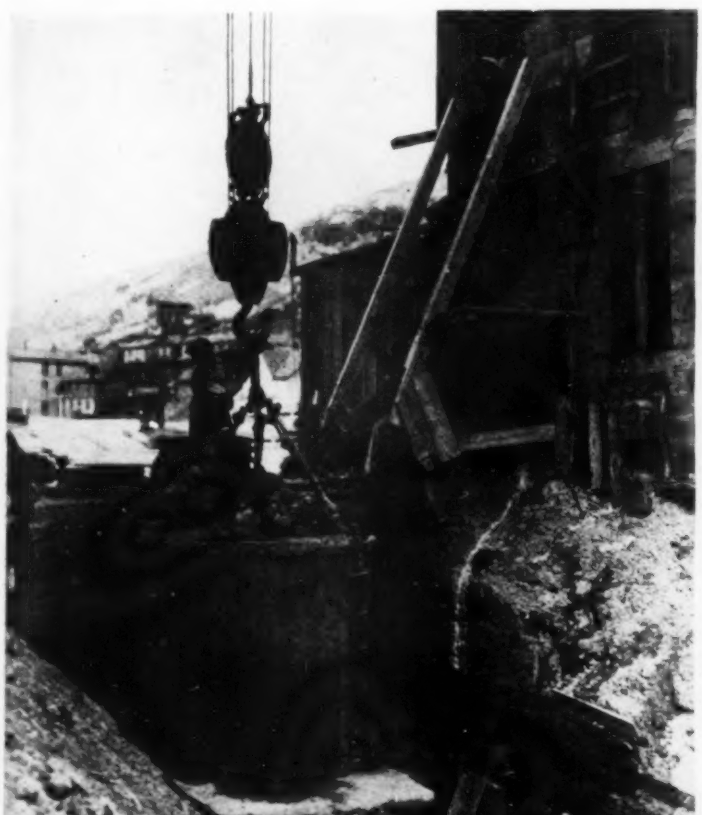
A central mixing plant on the Span 3 side of Pier 3 is producing all the concrete (approximately 37,000 yd.) except that in the piers below the 30-ft. level. The cableways place the concrete from Owen 5-yd. Stange buckets. A Jaeger 2-yd. mixer, powered by a Hercules 60-hp. motor, mixes 11- and 12-bag batches of 1:2:4 concrete. The McCrady-Rodgers Co. delivers batched aggregates by truck to a tower bucket which is raised to discharge into the mixer drum. A temporary bridge was constructed across the Turtle Creek to afford access to the plant from the street. Materials are batched by weight. Gravel was used in the pier concrete; but limestone is specified for arch ribs, columns, and deck. Concrete for the sidewalk will be 1:2:3 mix.

Sacked cement is delivered to the plant by trucks and is stored in a shed. The cement for a batch is dumped into an end-tipover car which is pushed to the end of a narrow-gage track to discharge its load into the tower bucket.

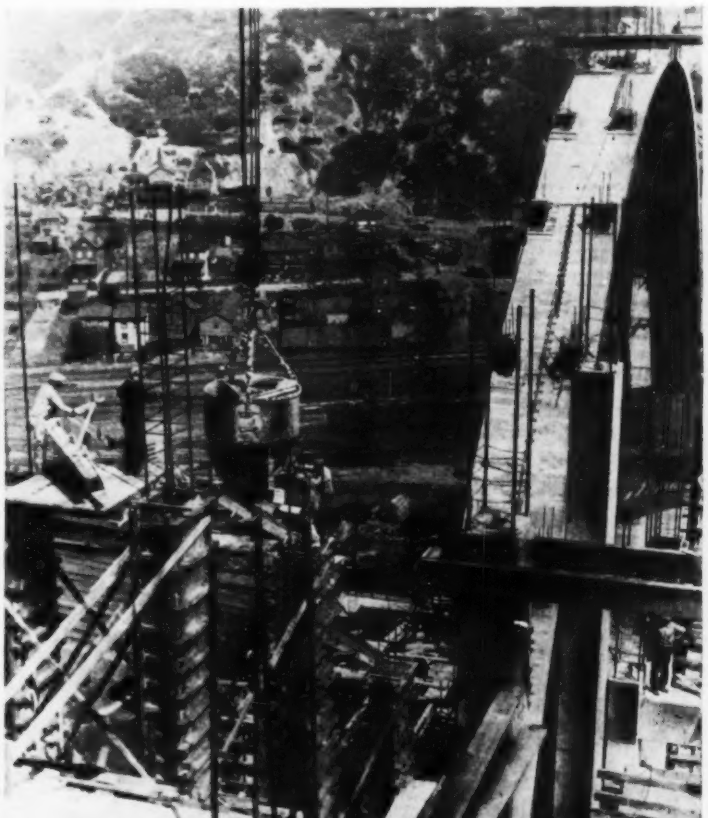
Mixed concrete is discharged directly into a 5-yd. bucket on a narrow-gage flat car of two-bucket capacity. The cableway deposits an empty bucket on the car and picks up a loaded one. A hoist-operated endless cable spots the car under the mixer and cableways.

Supervision—A. Rex Flinn is president of the Booth & Flinn Co., for which George Hockensmith is in general charge, with N. H. McLain as superintendent. R. A. Alexander as assistant superintendent, and Charles E. Whitcomb as job engineer. Under Norman F. Brown, director of the Allegheny County department of public works, and V. R. Covell, chief engineer of the bureau of bridges, S. R. Harper, assistant engineer, is in charge of construction for the county and state.

NEXT MONTH—*More pictures showing progress of construction on the Hoover Dam.*



5-YD. CONCRETE BUCKET is deposited on car at mixing plant by cableway. Cableway will pick up loaded bucket. Car is moved by hoist-operated continuous rope.

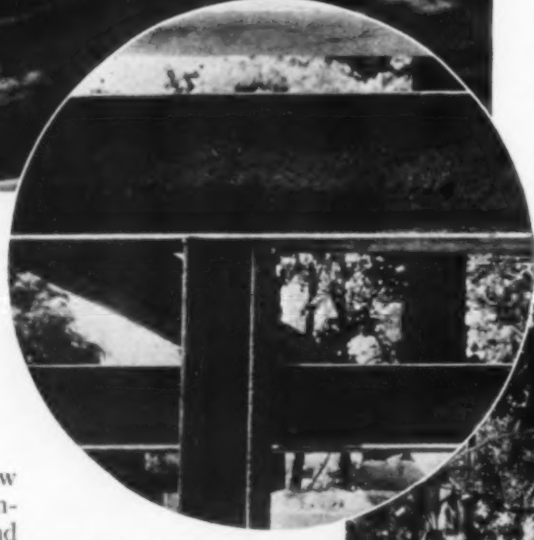


POURING COLUMN on north rib, Span 5, with 5-yd. bucket handled by cableway.

Seven-Room Steel Frame House

ERECTED BY ARC WELDING

SILLS AND FLOOR JOISTS are, respectively, 3-in. 5.7-lb. and 6-in., 12.5-lb. Carnegie I-beams. Note 10-in. variation in levels of first floor.

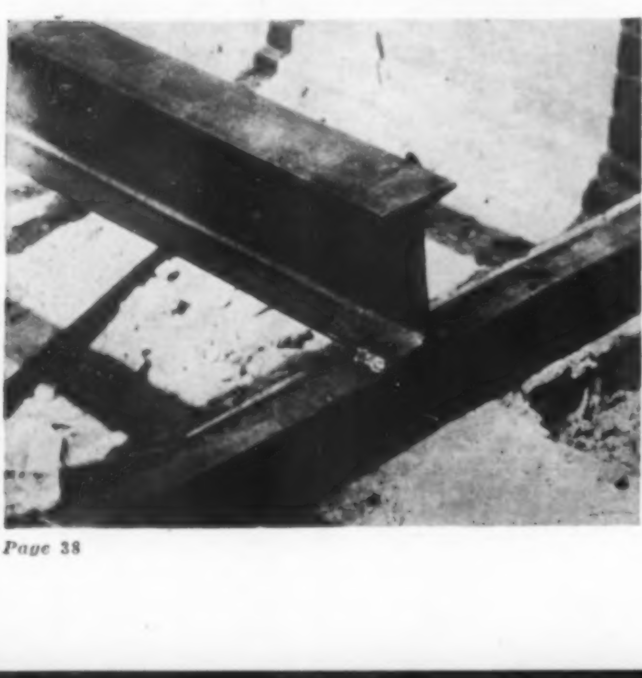


BASEMENT COLUMNS, 4-in. I-beams, support 8-in. I-beams which carry the floor joists. Simple welded connection ties column to girder.

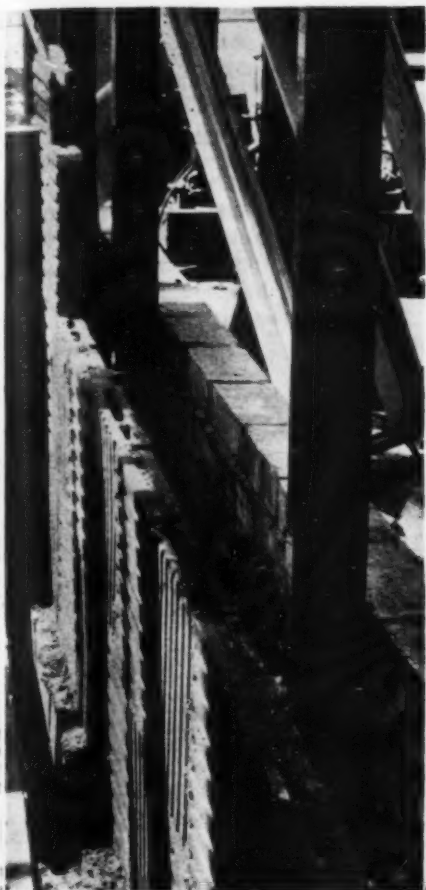
TO MEET requirements of low cost; simplicity of design and increased strength, insulation and permanence by the application of skyscraper materials and methods to residence construction, what is claimed to be the first house of complete arc-welded steel construction in the United States has been erected in the Shaker Heights district of Cleveland from plans prepared by George Howard Burrows, architect. The seven-room structure, costing about $25,000, is a two-story building of Norman-French design, involving the use of about 10 tons of steel in the framework.

Standard steel shapes cut to length at the mill included, principally, 3-in. lightweight Carnegie channels and 6-in. lightweight Carnegie beams. All fabrication and erection was done with Lincoln stable-arc electric welding equipment by the McKay Building Co., of Cleveland. The design made it possible for the steel to be delivered from mill to site and erected without punching or cutting. The cost of the house, according to Mr. Burrows, is 40 cents per cubic foot. On a basis of comparative estimates, the electrically welded steel-frame structure is said to exceed the cost of a comparable wood

PLUMBING AND WELDING 3-in. channels serving as studs for first and second floors.



TACK WELDS (*left*) are made at floor joist and sill connection. All but two connections are direct bearing joints.



WALL DETAIL (*above*) showing 3-in. dead-air insulating space between outer shell of 4-in. face brick and inner shell of 2-in. hollow tile.

frame house by only $72. With one welder and three structural iron workers, approximately 4 tons of steel were erected during the first day of construction. The welding machine used was a portable, gasoline-driven unit. Steel erection was supervised by Louis K. Whitcomb, structural engineer for the Carnegie Steel Co.

Upon the masonary foundation 3-in., 5.7-lb. I-beam sills extend around the building and are welded to 3-in. I-beam columns. Floor joists are 6-in., 12.5-lb. I-beams.

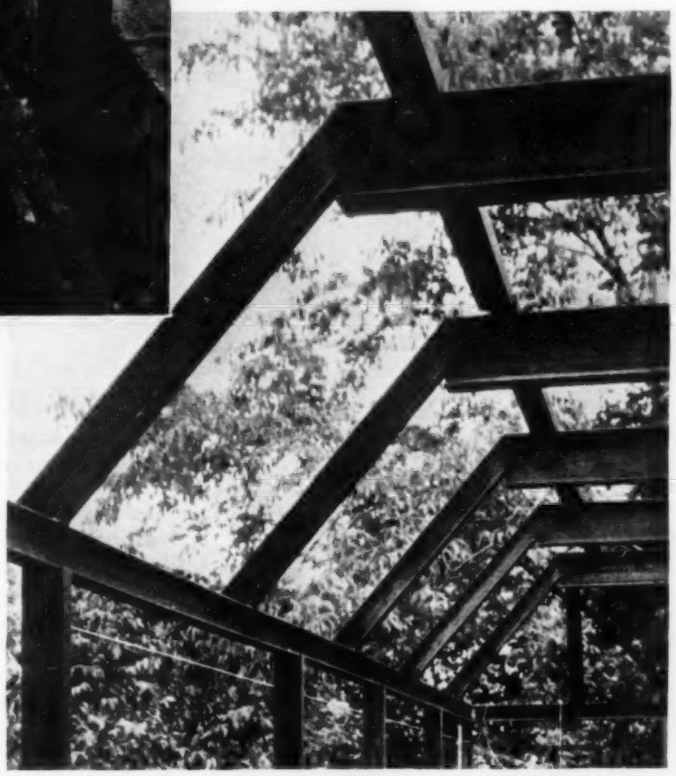
The wall construction consists of an outer shell of 4-in. face brick and an inner shell of 2-in. hollow tile. Brick is reinforced laterally with steel rods. The masonry is tied to studs with slips wedged on to the flanges of the channels. Insulation is secured by a 3-in. dead-air space between the inner and outer wall shells.

Ceilings are 2-in. poured concrete slabs reinforced with $\frac{1}{4}$-in. steel rods. Across the steel floor joists, 2x4-in. wood sleepers are laid to support the sub-floors and allow for wiring or piping.

Among the advantages claimed for this all-welded steel-frame type of residence construction are strength, rigidity, low depreciation, resistance to fire, sound-proofness and reasonable cost.

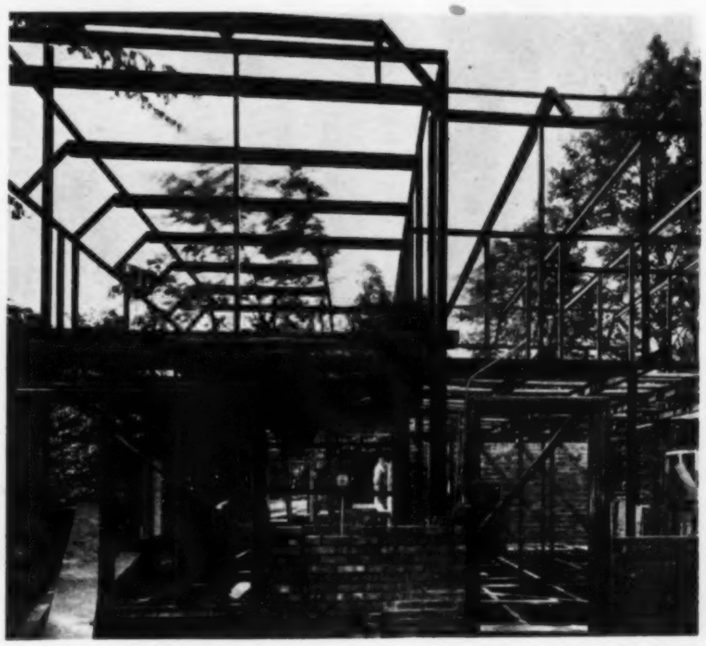
ANGLES, arc-welded to floor joists, carry masonry for rear wall.

PITCHED ROOF (*below*) requires splice connection between 3-in. I-beams and 6-in. floor joists. Angles welded to top flanges of floor joists for lateral bracing. Splice joints, in shear, are only ones made on ground before erection.



COMPLICATED FRAMING (*below*) of steelwork around offset in front exterior wall is required by Norman-French architecture.

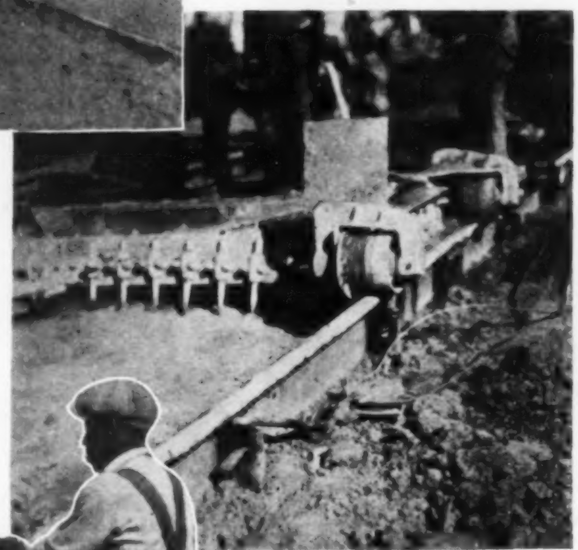
COMPLETED STEEL FRAME for seven-room house, showing masonry, doors and window frames.



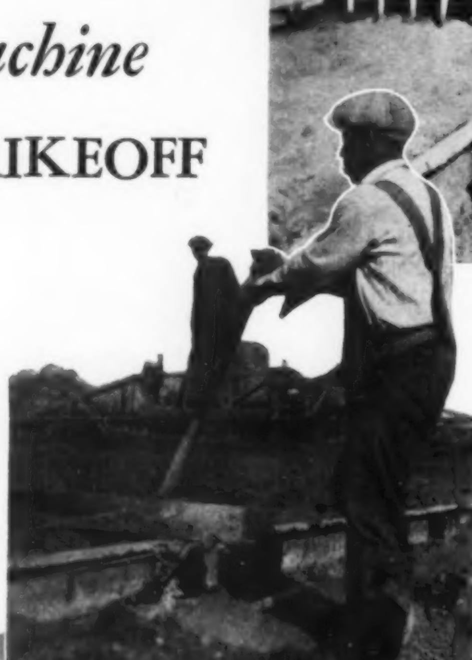
STEEL strikeoffs operated by movement of the finishing machines have been used by several contractors on St. Louis County roads to level concrete for installation of wire mesh reinforcement. St. Louis County pavement is designed with 42-lb. mesh 2 in. below the surface. Prior to the development of the strikeoff, contractors had been under considerable extra labor expense in leveling the first layer of concrete to carry the mesh. Extra labor still is required with the strikeoff; but the time consumed in the leveling operation is much reduced.

STEEL STRIKEOFF, operated by finishing machine, levels concrete for wire mesh reinforcement. Man in background is pulling back one hauling rope to hook it to finishing machine.

Finishing Machine OPERATES STRIKEOFF *on St. Louis County Roads*



PULLEY SHEAVE, hooked to road form, carries hauling rope used to pull strikeoff.



HANDLE *(right)* at each end of strikeoff enables workmen to manipulate it easily.

AFTER STRIKEOFF HAS LEVELED CONCRETE, wire mesh is laid in place.

Moore Bros. Construction Co. of East St. Louis, Ill., and the William A. Riley Construction Co. of St. Louis, are two contractors who have used strikeoffs successfully in building concrete roads on St. Louis County's $10,000,000 highway construction program, a bond issue for which was authorized in 1927. Construction started in 1928, and each year has seen an increasing expenditure. Approximately $3,500,000 had been spent by Jan. 1, 1931.

Both the Moore and Riley contracts were for 9-7-9-in. concrete slab 20 ft. wide, with a metal center-line joint and 1-in. transverse expansion joints 100 ft. apart. Transverse steel contraction joints were spaced every 33⅓ ft. between expansion joints.

The steel strikoffs were equipped with runners which rode on the forms and with handles at both ends. A man at each handle kept the strikeoff at right angles to the form as it was pulled ahead. The handles also enabled the men to tilt the strikeoff in passing over joint strips.

To pull the strikeoff a line at each side, reeved through a pulley block, was hooked to the finishing machine. The blocks were anchored to the road

forms near the mixer. As the finishing machine moved backward, it pulled the strikeoff forward, leveling the concrete in a few seconds. After the steel mesh had been placed, additional concrete was dumped and the machine finished the surface.

Both contractors used Lakewood finishing machines and Koehring 27-E pavers, supplied with material by three-batch trucks. The Moore Bros. Con-

THREE-BATCH TRUCKS serve 1-yd. pavers on both jobs.

WILLIAM C. BERRY *(left)*, consulting engineer, and W. H. WHEELER, materials and testing engineer, St. Louis County.

struction Co. paved $4\frac{1}{2}$ miles on Page Ave. from a batching plant on a railroad spur. A gasoline crane with a $\frac{3}{4}$-yd. bucket handled sand and limestone into 15-yd. bins. The William A. Riley Construction Co. laid 4,000 ft. on Woodson Road with sand and stone hauled 7 miles from the Rock Hills quarry by the quarry company. Subgrade planers attached to the mixers were followed by manually-operated scratch templets to check the grade.

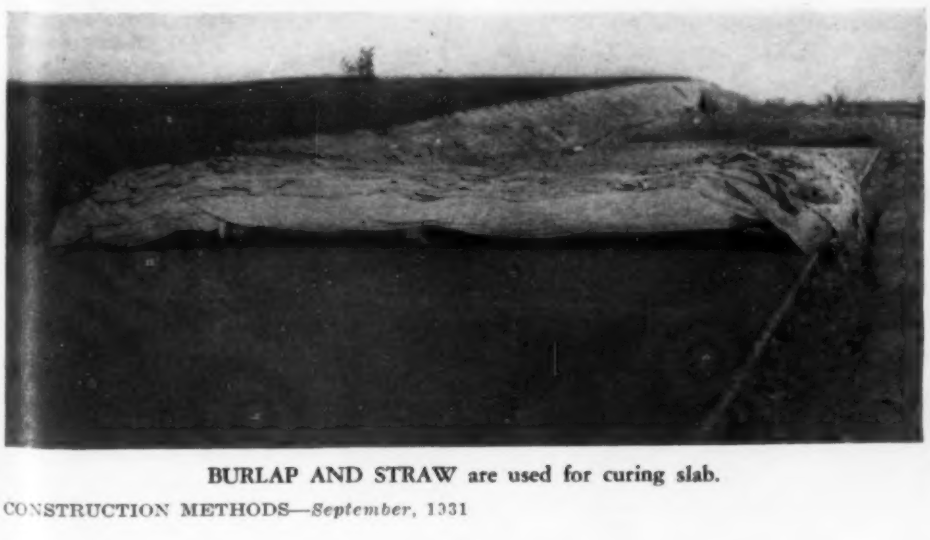
THOMAS MOORE, in charge of job for Moore Bros. Construction Co.

Burlap was spread on the surface as soon as the concrete had taken its initial set and was kept wet for 24 hours. The slab was then covered with straw and allowed to cure for 7 days. Although specifications required 14 days before opening to traffic beam tests usually showed a high enough strength to permit opening at 10 days. High-early-strength concrete made with Prestolite cement was used at important intersections to obtain prompt reopening.

The slab was reinforced at each edge with a $\frac{3}{4}$-in. round bar which was cut off at each transverse joint. Dowel

C. W. CURRY *(left)*, superintendent, and WILLIAM A. RILEY, of William A. Riley Construction Co.

rods $\frac{1}{2}$ in. in diameter and 4 ft. long were used in the center-line joint at 5-ft. intervals, and $\frac{3}{4}$-in. dowels 4 ft. long spaced 2 ft. apart were installed in the transverse joints. Half of each dowel was oiled at the transverse joints, and a metal sleeve was placed on the oiled half at the expansion joints.



BURLAP AND STRAW are used for curing slab.

VULCANIZED PATCHES

Maintain Asphalt Pavements

By W. H. DROEGE

Asphalt Paving Chemist
Fort Wayne, Ind.

A TOTAL of 1,867,000 sq.yd. of asphalt paving from 9 to 42 years old in Fort Wayne, Ind., is kept in repair by a method known as vulcanized patching. The procedure, as illustrated in the series of pictures below, is simple, economical and practically fool-proof; it has been followed in Fort Wayne for the last 15 years.

Using Texaco asphalt, the top mixture is produced at the city's 500-yd. plant. By the method illustrated the cost of patching, including materials, hauling and labor, both at the plant and on the street, is less than $1 per square yard. Pavement maintenance is carried on winter and summer. An asphaltic cement of high quality, not harder than 50 penetration, is used in preparing the mixture for the patching. A low-bitumen mixture would not stand manipulation by the vulcanizing method.

1 WORN AREA of asphalt pavement is cleaned and dried with blow torch of low heating intensity preparatory to painting edges of area with hot asphaltic cement applied by broom.

2 PAINTING EDGES with hot asphaltic cement is extended to width of 5 to 6 in. Center of patch is heavily sprinkled with pure asphaltic cement; cut-back asphalts are not used for paint coat in patching.

3 BLOW TORCH is applied rapidly up and down the edges and center of the patch to soften asphalt paint. Then hot mix is instantly applied and raked. Torch precedes smoothing iron, drawing paint coat through new mix along joint of patch.

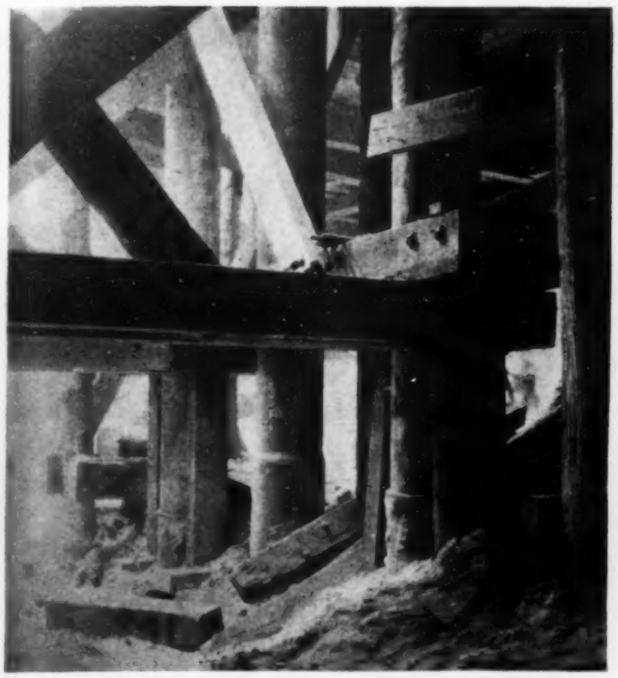
4 VULCANIZED SEAL results when heat of blow torch draws asphalt paint through mixture to surface, causing perfect bond between edges of patch and existing pavement.

5 ROLLER compresses patch mixture after surface has received a light sweeping of portland cement to prevent asphalt paint sticking to roller wheels.

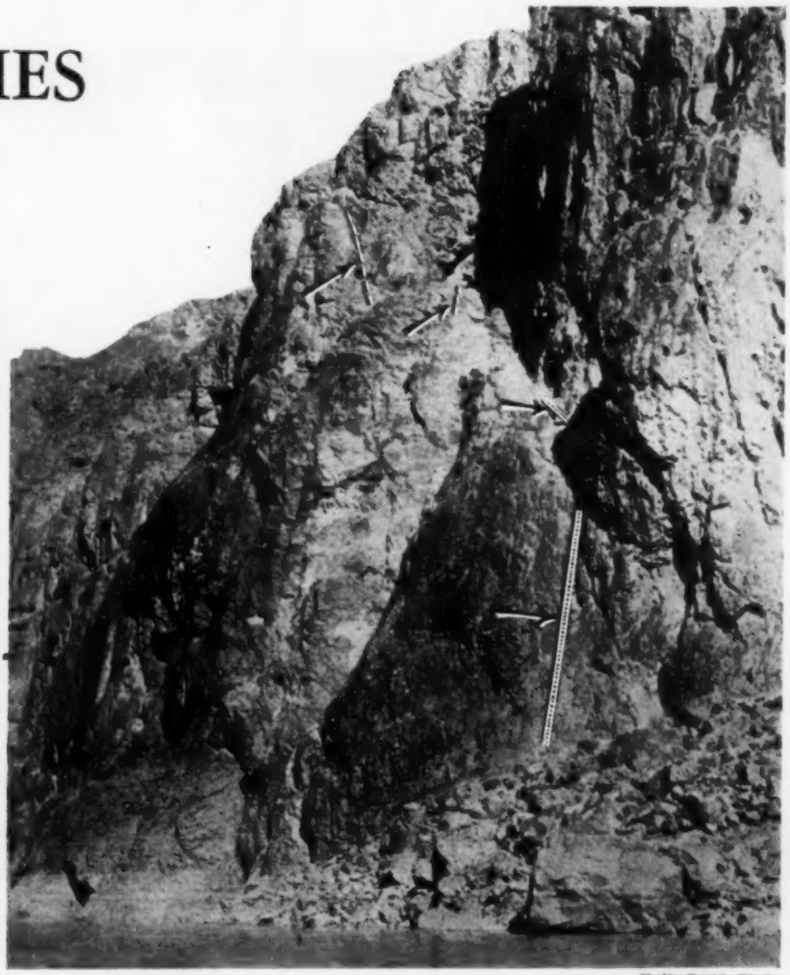
6 COMPLETED PATCH one year old. Many asphalt paving patches made by the method above outlined are in good condition after a service of 15 years.

JOB ODDITIES

A Monthly Page of Unusual Features of Construction

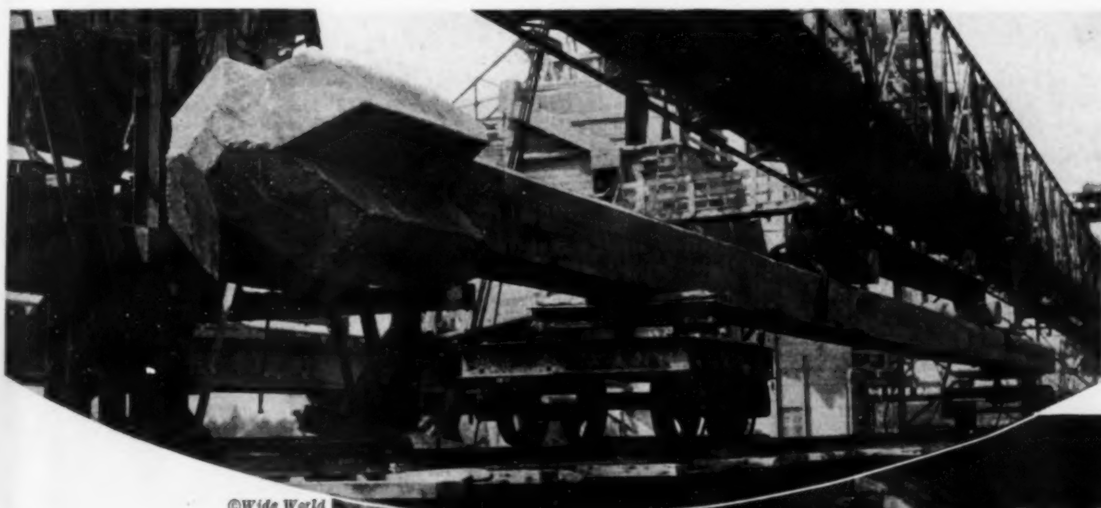


TELESCOPED. New York subway excavation reveals steel pipe pile sections driven outside or inside other sections without fracture.



Union Pacific Photo

A LONG CLIMB is offered to Hoover dam workers by ladders extending 600 ft. along steep face of Colorado River Canyon



©Wide World

DUTCH SPEARHEAD (*left*). Long precast piles of reinforced concrete, with large pointed ends, are driven to support new skyscraper under construction near one of the numerous canals in Holland.

FOR TALKIE CONSTRUCTION (*right*). Fleet of 100 trucks and trailers delivers 1,800,000 ft., board measure of lumber to Universal Film Corporation studios near Los Angeles, Calif. Material is for use in building sets and stages for production of sound pictures.

Confidence!

TO the credit of the Link-Belt Shovel-Crane-Dragline let it be said that users have confidence in its builder and its performance—confidence that has been earned through the years, in all kinds of work.

Link-Belt has merited this confidence because of its policy of always giving more, not less than we promise.

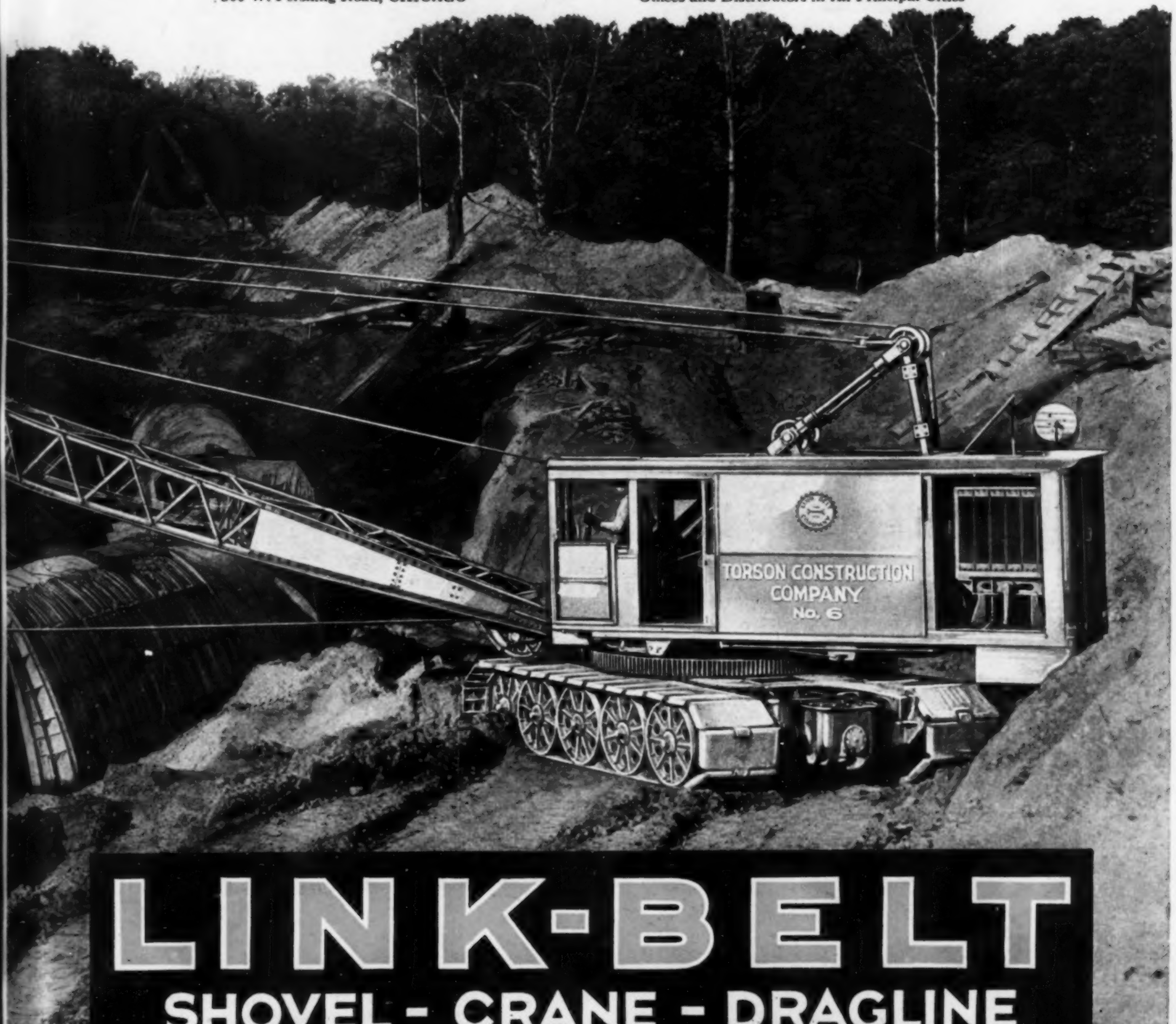
Here is a case in point. The Torson Construction Company have purchased ten Link-Belt machines since 1924. They have used them on all kinds of work, all over the country. Illustrated here is one of their five Link-Belt draglines on the Southwestern Outfall Sewer job at Louisville, Ky.

The good-all-the-way-through quality of Link-Belt Shovels-Cranes-Draglines makes friends that "stick". Charles M. Torson is one who says that the Link-Belt is the only machine he would ever buy. Link-Belt users usually repeat. That is "confidence".

4852

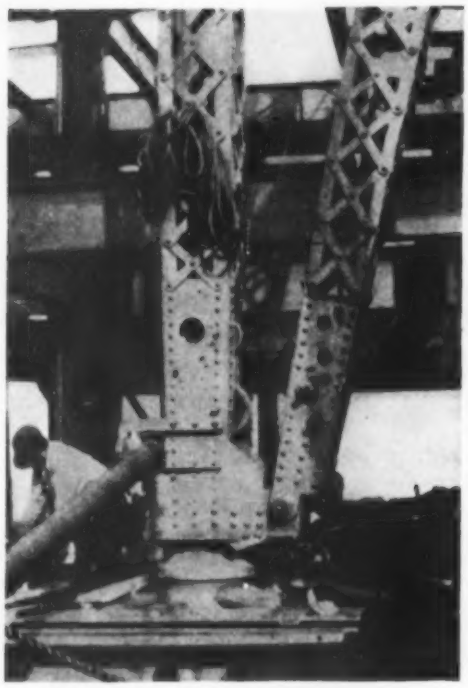
LINK-BELT COMPANY

300 W. Pershing Road, CHICAGO — Offices and Distributors in All Principal Cities

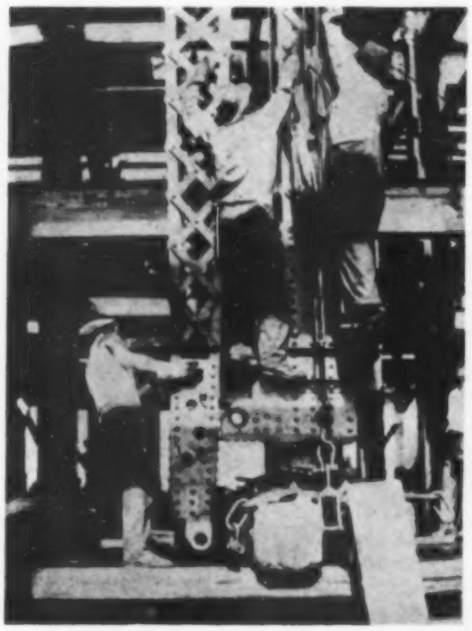


Step-by-Step

JUMPING A

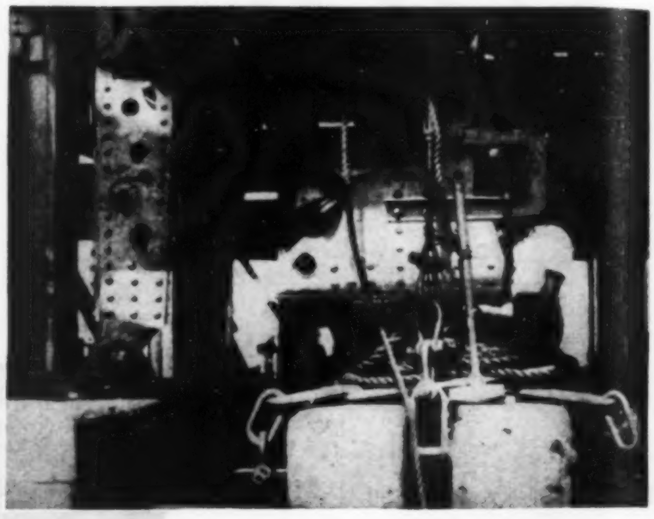


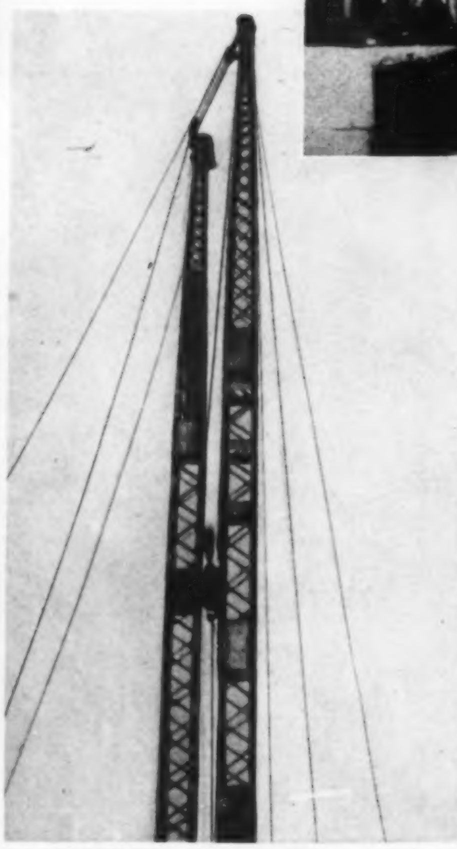
1 FOOT OF DERRICK is shown as steel is being erected for two floors above the one on which derrick is standing. As soon as all the steel for the two stories is erected, the—



2 BOOM HEEL PIN is pulled out and boom is lowered, as shown. Foot-block has been temporarily fastened to mast with turn-buckles and shackles.

3 BOOM IS TURNED *(right)* 180 deg., and device is fastened to foot of boom with boom heel pin, to protect foot of boom which is then landed on timbers, as shown. Boom was turned 180 deg. so that—





4 LOAD FALLS can be hooked on to mast. Four jumping guys extend from top of boom to sets of falls to hold boom as a gin pole for raising mast. Load block is now between boom and mast instead of outside of boom.

5 MAST HOOKED UP ready to be picked up by load cable.

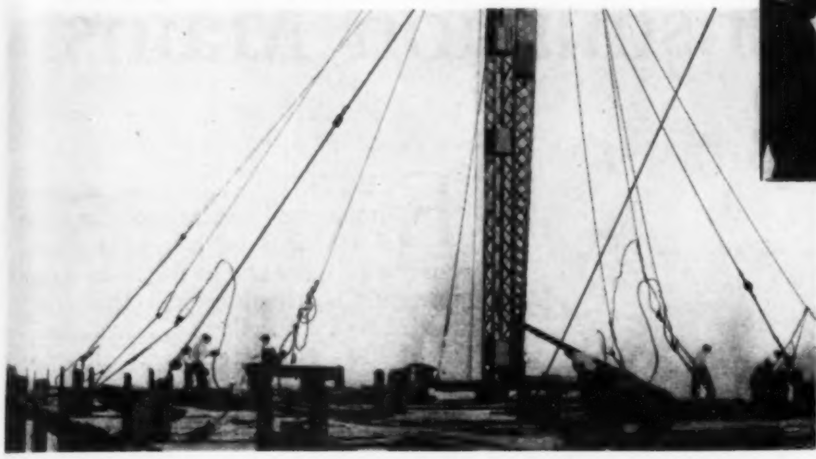
BY WM. G. RAPP

Field Engineer
McClintic-Marshall Co.

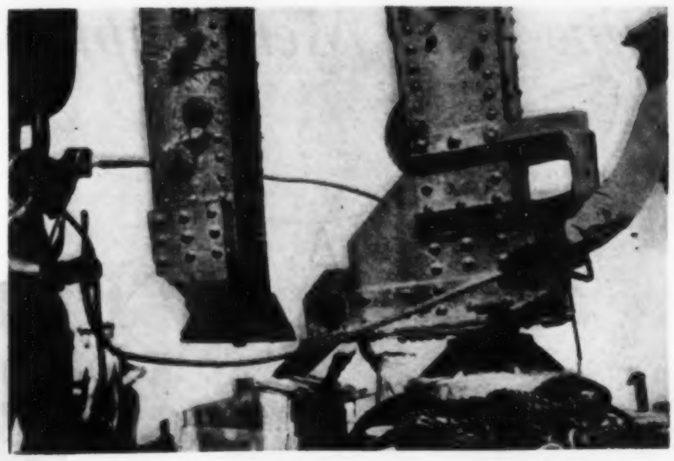
6 WHEN FOUR GUYS *(left)* have been fastened to boom, a slight strain is taken on load line and mast is thus held up by boom. Next, guys ordinarily holding mast are cut loose from columns on derrick floor and are brought up two floors and fastened anew in readiness for new position of mast.

Field Methods

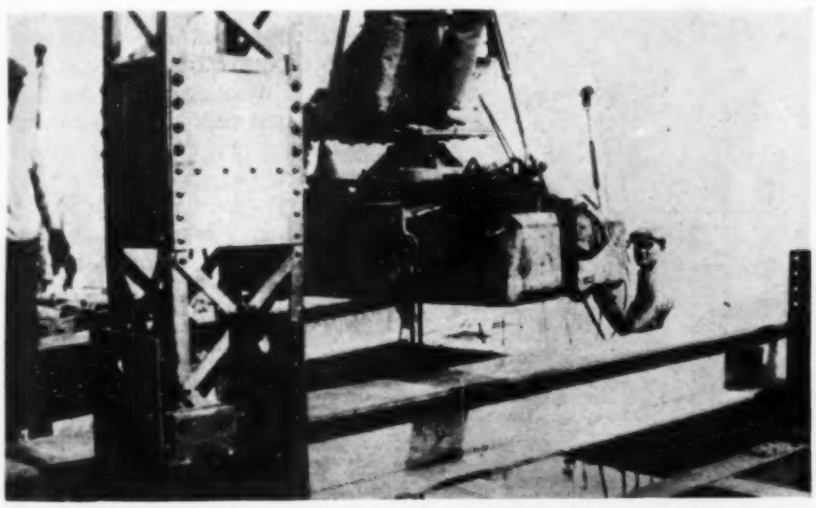
GUY DERRICK



7 ENGINEER now goes ahead on load line cable and mast is picked up by load line, boom acting as gin pole. Mast guys are gradually taking up slack so that, when mast is up, guys on it will be all ready to go to work. Falls hold guys to top of boom.

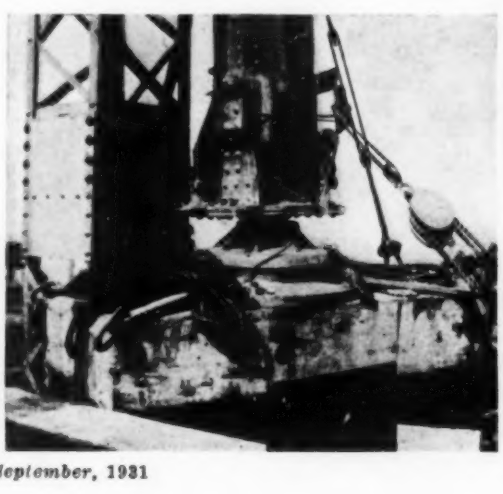


10 BOTTOM OF BOOM has been pulled up by mast. Note device to protect foot of boom. Next, by putting sling around foot of mast and hooking it up to the load hook and—

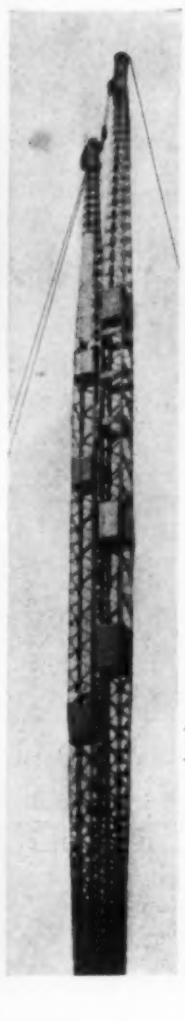


8 FOOT OF MAST is raised a little higher than the two steel beams on which derrick is supported at each stage of erection. These beams have been spread enough to let the foot-block come up.

11 GOING AHEAD ON LOAD LINE *(above)*, foot of boom is pulled over to mast and when in its proper position pin is inserted.



9 SLACKING DOWN *(right)* foot of mast to rest on steel jumping beams. Next, guys to top of boom are all made tight and four guys which held boom as gin pole are cut loose. Engineer now goes ahead on boom falls cable, and instead of boom booming-up, head of boom is drawn directly upwards to top of mast.



12 DERRICK IS READY *(left)* to go to work again. Derrick shown has a 90-ft. mast, 80-ft. boom and is one of two used by McClintic-Marshall Co. in erecting the structural steel in the Radio Corporation of America Building, New York City.

Pipe-Line Men Improve Methods of Constructing

Large Gas Transmission Mains

Part IV

Electric Welding, Cleaning and Covering Pipe

ON 26-IN. SOLID-WELDED LINE from Kettleman Hills to Los Angeles, ditching crew precedes lining-up gang, and pipe and rollers are mounted on cross-timbers over trench.

TACK WELDING JOINT *(right)* with four 2-in. welds spaced equally around pipe.

ELECTRIC welding is a most important method of making field joints on large gas transmission pipe lines. On the 24-in. Continental Construction Co.'s line from the Texas Panhandle to Chicago, made up of 40-ft. pipe lengths with alternate welded joints and Dresser couplings, about 402 miles was electrically-welded in the field and about 480 miles at plants of the steel companies furnishing the pipe, by the Welding Engineering Co., of Bartlesville, Okla., the A. O. Smith Co., and others.

Development of the shielded-arc process and of high-speed welding electrodes has increased the rate of joint construction and encouraged a speeding up of other operations. According to field data assembled by the engineering department of the Lincoln Electric Co., one welding crew using Fleetweld electrode can maintain a conservative average of nineteen joints on 20-in. pipe per 9-hour day. Some units have averaged 30 joints a day

FIRING-LINE GANG equipped with four Lincoln portable gasoline-engine-driven units welds over mile of 20-in. line each day. Generating machine is 400-amp., driven by six-cylinder motor, and is equipped with device which automatically idles engine 10 sec. after arc is broken. When arc is restruck, engine speeds up instantly. Device saves gasoline.

FIRST STEP *(below)* in welding joint is to insert backing-up ring in one pipe section, on rollers, tack ring to pipe with one weld, and fit next section on ring. Tack weld which fastens ring to first pipe can be seen at top of joint.

on 20-in. pipe. Use of 18-in. electrodes instead of the old 14-in. length helped to speed up welding by eliminating frequent changing of electrodes.

In the shielded-arc process the electrode is coated with a special composition which burns in the arc, excluding air and practically eliminating oxides and nitrides which cause porosity, brittleness and poor ductility of weld metal. The coated electrode also deposits a layer of easily removable slag which protects the metal while cooling. Used at the maximum welding current, the electrode obtains deep penetration and more perfect fusion. The maximum time for making each connection with the shielded arc is figured at 1 min. per inch diameter of pipe.

For gas transmission mains, plain butt-end pipe bevelled at 30 deg. is used. The joints are backed up with a chill ring. Formerly, the sections were lined up on skids, but use of rollers to facilitate turning the pipe has made greater speeds possible.

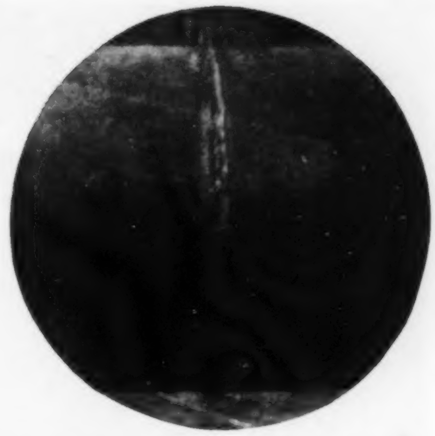
Preliminary Operations—The line-up gang uses a small crane to handle the pipe. After a pipe section has been placed on rollers, the backing-up ring is inserted in one end and is tacked to the pipe with one weld. The gang then fits the next section on the ring.

Following the line-up gang is the tack-welding crew, which joins the two pipe sections with four 2-in. welds spaced equally around the pipe. This crew used $\frac{1}{4}$-in. or $\frac{5}{16}$-in. electrodes.

Welding Joints—Final welding of joints is performed by the firing-line gang, which is made up of from three to five units. Each unit consists of a portable gasoline-powered electric generator, a welder, and two helpers. One helper turns the pipe with a chain wrench while the other scales and brushes the bead.

Two beads are made at each joint.

CORRUGATED EXPANSION JOINT ***(indicated by arrow, below)*** **is used in 26-in. California line. Solid-welded lines require provision for expansion. Hose connection is for initial pressure test on welded section.**



BURNING-IN OR STRINGER BEAD after scaling. Two beads are made at each joint, first being stringer bead, welded with $\frac{1}{4}$-in. or $\frac{5}{16}$-in. electrode. Helper scales this bead while operator welds next joint along line, pipe being turned simultaneously for both operations.

BELL-HOLE WELDING CREW ***(right)*** **ties sections into line. As pipe cannot be turned for this joint, operator, starting bead at top, welds around half of circumference and then repeats operation on other side while helper scales completed bead. Three to five beads are used for tie-in welds.**

SHIELD on pipe protects arc from wind and remains stationary while pipe is turned. Operator wears head shield and split-leather apron. Each unit, manned by one welder and one helper of Welding Engineering Co., Bartlesville, Okla., makes 50 welds per day, joining 40-ft. lengths of 24-in. pipe into 80-ft. sections, at yard of L. E. Myers Co., Chicago, contractors on portion of Continental line.

TYPE OF ROLLERS on which pipes are mounted to be turned easily during welding.

CLEANING PIPE on Henry Lemons, Inc., contract section of Continental line. Pneumatically-operated wire brushes are driven by air from Davey compressor mounted on Caterpillar tractor. Cup grinders are similarly operated to smooth rough welds before painting.

FOR LINES UP TO 12 IN. IN DIAMETER, W-K-M pipe cleaning and priming machine removes rust and dirt from surface and applies prime coat for enameling. Wheel on axle at side keeps machine on even keel.

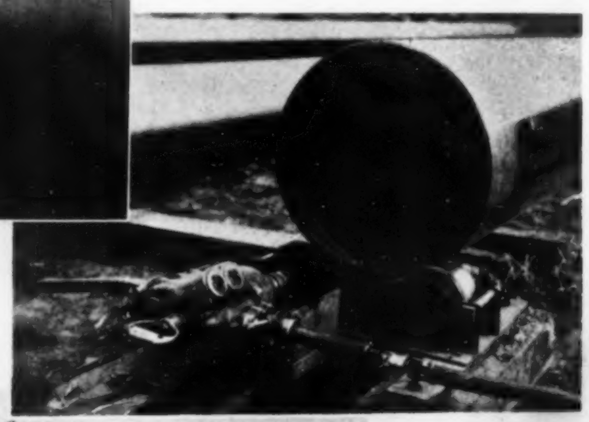
The first, called the burning-in or stringer bead, is welded with $\frac{1}{4}$-in., $\frac{5}{16}$-in., or $\frac{3}{8}$-in. electrodes. A helper scales the bead while the operator welds the next joint. Electrodes of $\frac{5}{16}$-in. or $\frac{1}{8}$-in. diameter are used for the finish bead.

Tie-in welds are made by the bell-hole crew, as illustrated by one of the photographs. A tie-in weld consists of from three to five beads.

Mechanical Developments—Notable improvements have been made recently in methods of cleaning, priming, enameling and wrapping pipe. The light, tractor-mounted air compressor has proved a convenient and easily

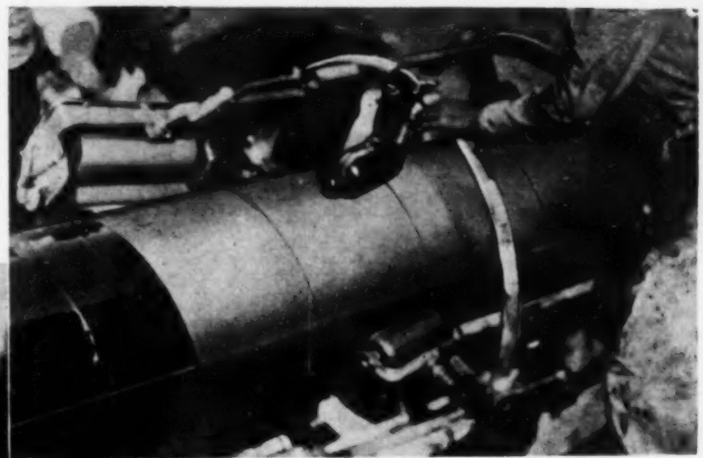
METAL SPREADER *(right)* attached to pouring can applies hot Wailes Dove-Hermiston bitumastic enamel to 24-in. pipe. Extreme edge of spreader is curved to obtain practically line contacts between spreader and pipe. Equipment eliminates extra man and distributes enamel more evenly than older methods.

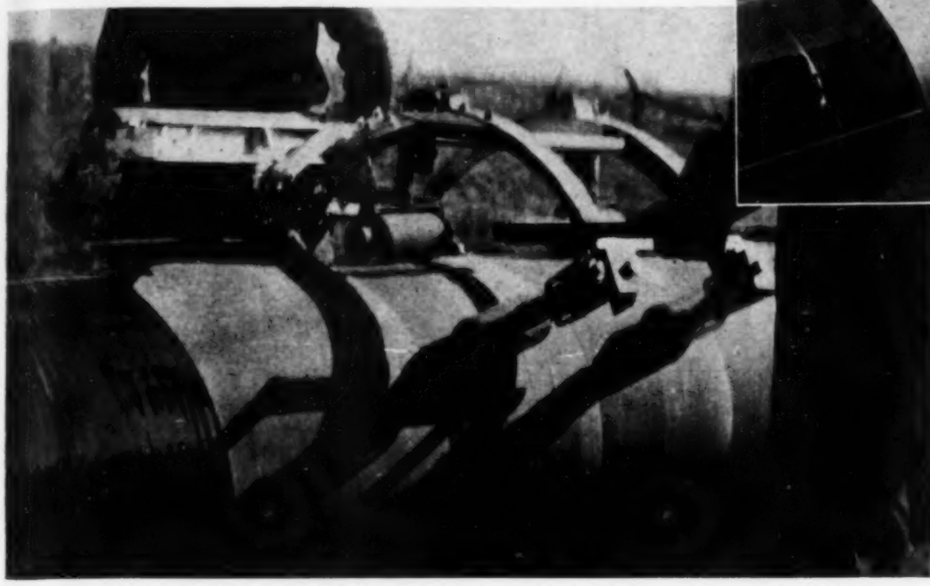
CENTER CUTOUT *(left)* on spreader controls flow from pouring can to pipe.



AIR-POWERED TURNING RIG *(left and above)*, operated by 142-cu.ft. air-cooled Davey compressor mounted on Caterpillar tractor, revolves pipe at uniform rate during application of hot enamel, eliminating extra labor and facilitating even coating of pipe for Williams Bros., Inc. Tractor-compressor outfit is many-purpose unit, being equipped with air-driven boom hoist which handles and spots pipe.

ROTARY-TYPE PIPE-WRAPPING MACHINE *(right)* applied Johns-Manville asbestos felt with 1-in. lap at the rate of 15 ft. per minute on solid-welded line. Machine, developed by Johns-Manville and W-K-M companies, consists of circular angle frames carrying roll of felt and riding on spring-mounted rubber rollers which iron felt as it is applied. Hinged frame facilitates removal from pipe. Two men operate machine, which weighs about 400 lb.





SADDLE - TYPE PIPE - WRAPPING MACHINE *(left)*, of Johns-Manville and W-K-M origin, is used on lines having coupled joints. It resembles upper half of rotary type; but it is not revolved around pipe. Pipe is rotated by turning rig while two operators walk along with wrapping machine riding on top of pipe.

mobile power supply for rolling rigs to turn the pipe and for pneumatic brushes and grinders to clean it. In addition to these services, the tractor-compressor unit often is equipped with an air-driven boom hoist to handle pipe. The use of the air drill for turning the rolling rig is one instance of the possibilities which the compressor has brought into the pipe-line field. The compressor feature in no way interferes with the use of the tractor for drawbar work or other purposes. A. W-K-M machine which travels on the pipe has been perfected to clean lines up to 12-in. in diameter.

An ingenious air motor, illustrated herewith, turns the rollers while the pipe is being enameled. A metal spreader attached to the pouring pot has increased the efficiency of the enameling operation. Pressure spraying equipment has demonstrated its advantages over the brush method of applying primer. Wrapping machines have been developed, as illustrated, for solid-welded and for couple lines.

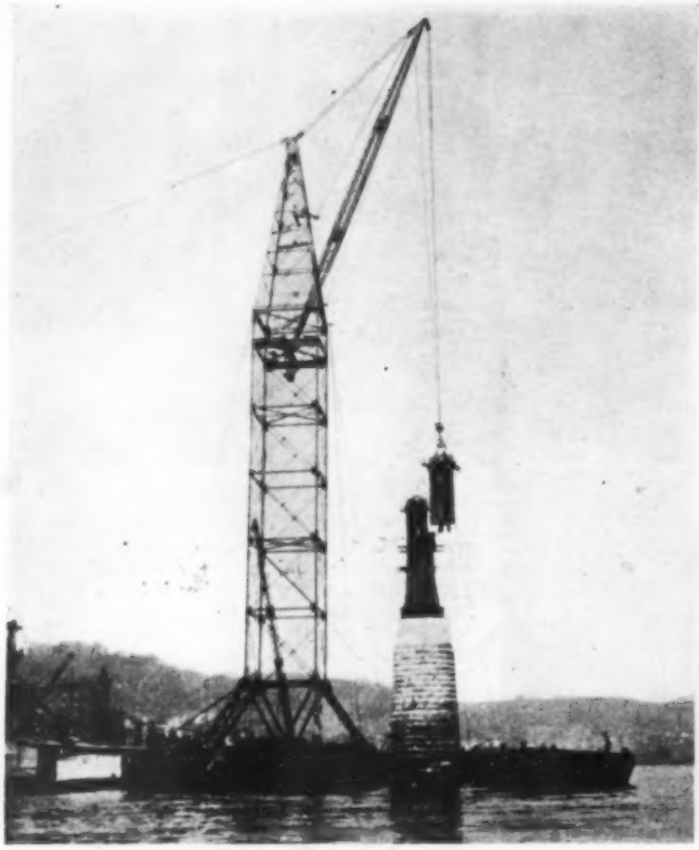
Wrapping machines of the types illustrated not only give a tighter job, with a more uniform lap than was possible with hand wrapping, but they also are faster and more economical. A rotary machine can wrap 1 to 1½ miles a day with two pairs of men.

COUPLING COATER in position on 18-in. Texas line of United Gas Co. Semicircular pan is held tightly against bottom half of pipe by chains attached to levers. Operator pours hot Wailes Dove-Hermiston coupling coating over all parts of upper half. Excess runs down into pan until pan is full, thus coating full circumference of coupling, as well as several inches of pipe on both sides. After coupling is thoroughly coated, valve in bottom of pan is opened, and hot coating drains out into pail hung under pipe.

SPRAY-PAINTING OUTFIT applies cold prime coat to one-third of pipe, operators walking length of section three times and finishing at far end. Binks outfit consisting of three nozzles mounted on knife-edged wheels has several adjustments for regulating spray and coating pipe from 12 to 30 in. in diameter. Material pressure container of 65-gal. capacity and 36-cu.ft. gasoline-engined air compressor weighing 790 lb. are carried on truck or wagon. Third man walks with operators, carrying air-conditioning unit, air hose and primer hose. It is claimed that crew totaling seven men can prime-coat 5 miles of 24-in. pipe per day and obtain 4,300 lin.ft. of coverage from one barrel of primer.

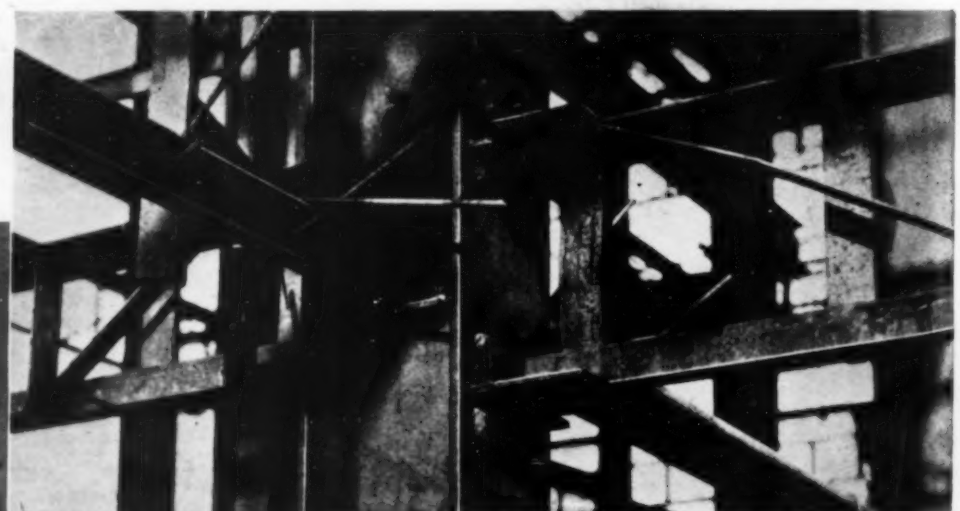
Getting Down to DETAILS

Close-up Shots of Job Methods and Equipment

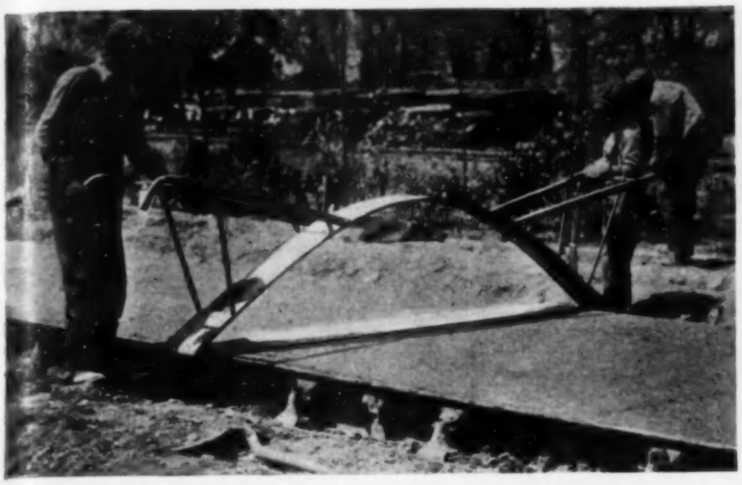


FLOATING DERRICK TOWER, handling loads up to 25 tons, facilitates erection of two main towers of Maysville-Kentucky bridge by John A. Roebling's Sons Co., contractor for superstructure and suspension cables. Structure across Ohio River has main span of 1,060 ft. Each of two bridge towers carrying suspension cables contains 350 tons of steel. Each of two derrick towers, involving 85 tons of structural steel, is mounted on two steel barges, lashed together. Each derrick tower, 200 ft. high above water level, is equipped with 125-ft. boom. Erection of derrick towers for Kentucky and Ohio sides of the river work required 3½ and 4½ days respectively.

SQUEEGEE CART applies hot asphalt filler to joints of brick pavement in Cuyahoga County, Ohio. Two-wheeled Littleford unit has squeegee of heavy belting and introduces filler into joints under pressure. Asphalt, heated to 375 deg. F. in large tank, is delivered in buckets to squeegee cart. Slag screenings are spread on jointed pavement while thin surface film of asphalt is still hot. Fred R. Williams, county engineer.

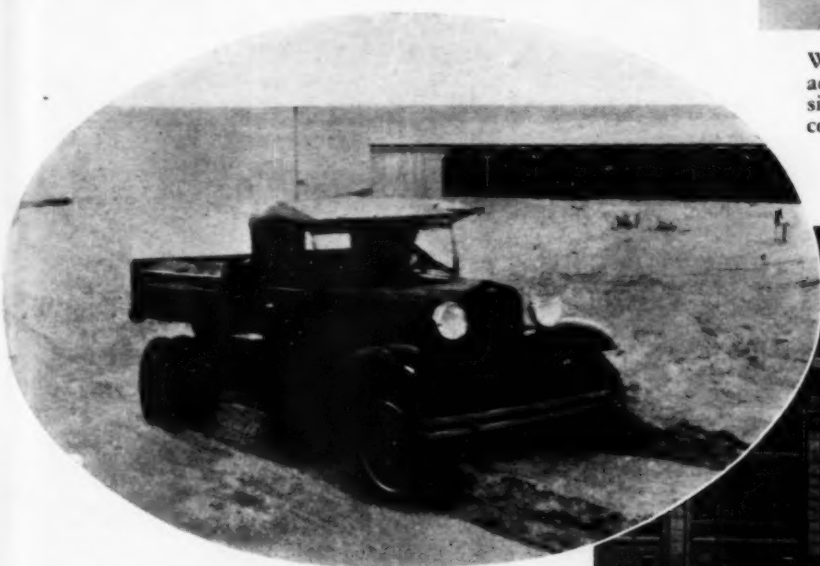


SIMPLE ERECTION SEAT *(at right and above)*, shop welded to columns and beams, eliminates use of punched holes and field bolts during construction of arc-welded steel frame for 18-story Allied Arts building, Lynchburg, Va. Beams are supported in erection seat by angles or split I-beam stubs welded to beam flanges. Erection seat is beveled on inside toward column or beam to which it is connected so that weight of floor member forces angle tightly against column to which it is to be welded. Erection seat illustrated was designed by Van Rensselaer P. Saxe, of Baltimore, Md. C. W. Hancock & Sons, of Lynchburg, Va., were the general contractors.



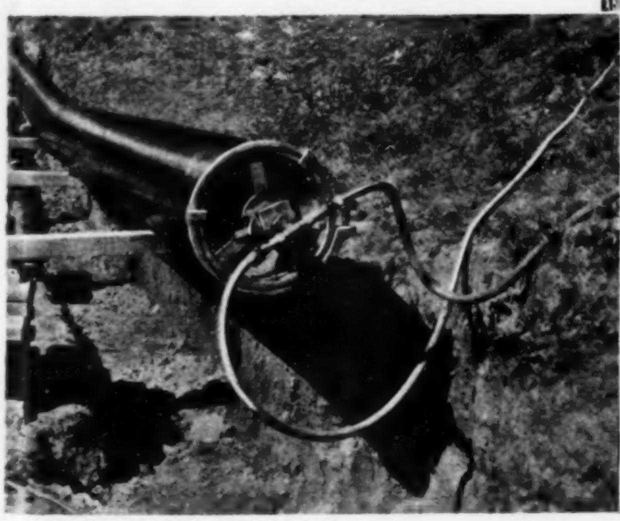
BOW FINISHER completes surfacing of concrete pavement on Mt. Vernon memorial highway near Washington, D. C. Handles facilitate operation of device by two workmen.

WRAPPING CABLES of St. Johns suspension bridge across Willamette River, Portland, Ore. Each cable consists of 91 strands of 1½-in. Roebling cable with fillers of cedar. Special machine wraps cables with No. 9 galvanized wire.



BALLOON TIRE PRESSURE of only 15 to 20 lb. per square inch enables eight trucks of Robert G. Lassiter & Co., of Raleigh, N. C., to traverse fine sea sand on sand-asphalt road construction along coast line of North Carolina. With ordinary higher tire pressures the trucks stalled. Low pressure in tires saved contractor cost of constructing temporary roads.

ELECTRIC ELEVATOR raises trucks from foundation to street level on Metropolitan Life Building, New York, under construction by Starrett Bros. & Eken, Inc., contractors. Steel head frame and vertical hoisting equipment take the place of the usual steep ramps for handling loaded and empty trucks on large skyscraper construction job in midtown New York.



REMOVABLE HEAD simplifies pressure test of 250-mile 20-in. welded gas pipe line of Pacific Gas & Electric Co. in California. Test head comprises external band, rubber gasket and internal ring fastened by set-screws.

JACKS

Raise 3,300-Ton Bridge 11½ Ft. to New Grade

By P. G. LANG, Jr.
Engineer of Bridges, Baltimore & Ohio, Chicago Terminal R.R. Co.

INCIDENT to rearrangement of railroad facilities at Chicago, Ill., a major bridge-jacking operation was performed by the Baltimore & Ohio Chicago Terminal Railroad Co. The general project involved the relocation of the South Branch of the Chicago River, the reconstruction and shifting of the affected bridges.

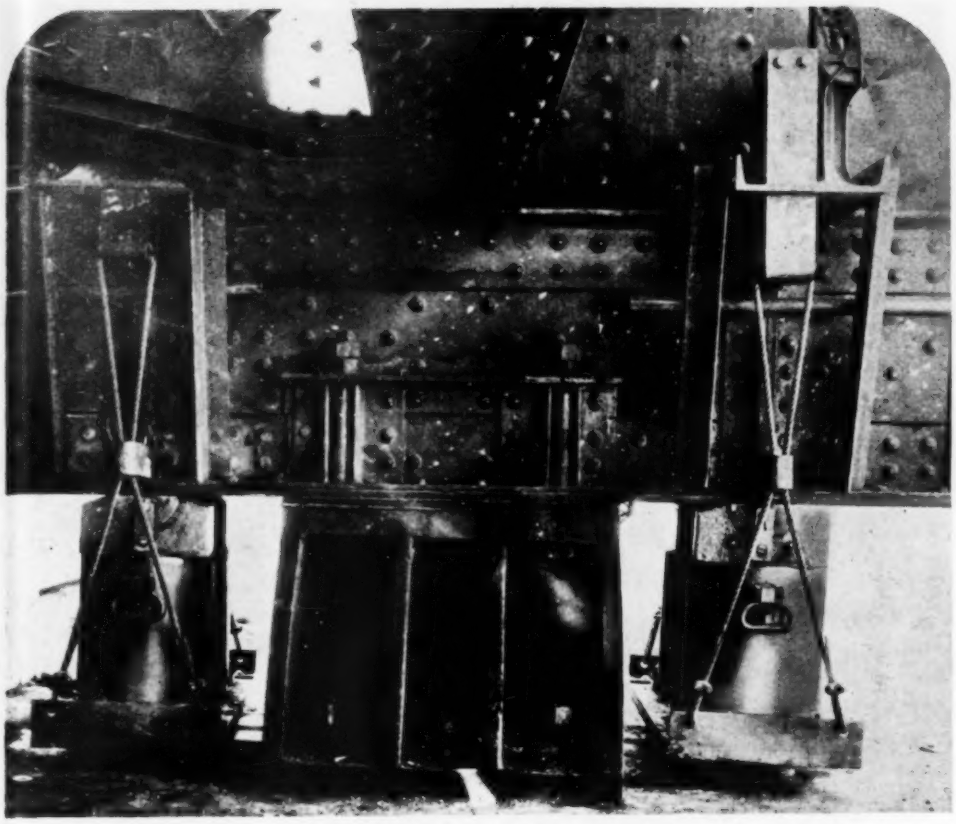
During 1928 the Baltimore & Ohio Chicago Terminal Railroad began work upon its new bascule bridge, designed to cross the relocated stream, and this structure was completed during the summer of 1929, before the new channel had been excavated. After the completion of this work, and the diversion of the waters, the St. Charles Air Line bridge was dismantled and reerected in its new location.

An important phase of the improvements in this vicinity was the separation of railroad grades at Stewart Ave., west of the river crossing, which involved the raising of the railroad tracks. The effect of this raise had received consideration in the arrangements for the bridges, and the contract let by the Baltimore & Ohio Chicago Terminal Railroad provided for construction at either level. Due to the general situation, the bridge was built at the low level, but provision was made in the design to facilitate its subsequent elevation.

The principal features of this project are apparent from the illustrations at the bottom of p. 55. The lower picture, looking westward from the river, indicates the present and future disposition of approach tracks. To the left appears the St. Charles Air Line viaduct; to the right the uncompleted viaduct of

IN RAISED POSITION. Movable span of bridge after jacking had been completed, showing details of metallic substructure, with all castings in place.

DURING JACKING OPERATIONS bridge was maintained in open position. A 25-mile gale during one day of jacking caused no difficulty or difference in the reactions.



INSIDE OF MAIN TRUNNION SHOE, with original pedestal in place. Jacks are mounted on 1½-in. steel tray carriers, the first step in operations. Note rocker heads on jacks.

the B.&O.C.T.R.R., with temporary connection to permit the use by its trains of the St. Charles Air Line structure. The crossing of the Pennsylvania tracks is also shown. The upper photograph, looking eastward, shows the disposition of tracks leading to the Grand Central Depot, including the temporary connection of the B.&O.C.T.R.R., which curves sharply to the left. To the left are the approach spans of the B.&O.C.T.R.R. bridge; the old channel of the Chicago River appears in the center, and the fill placed to accommodate the tracks at the higher elevation is also shown. The view includes connections with the New York Central, C.R.I.&P., Michigan Central and Illinois Central.

The actual work of jacking the B.&O.C.T.R.R. bridge to the new grade, a vertical distance of 11½ ft. was preceded by careful studies. The total weight to be lifted, including the steel superstructure, concrete counterweight, timber floor, machinery and electrical equipment was estimated at 3,330 tons. It was possible, by means of gages attached to the lifting mechanism, to ascertain the actual weight of the structure during the jacking operation, and this was found to be 3,370 tons, a variation of less than 1¼ per cent.

For the jacking, eight 300-ton jacks and eight 500-tons jacks were used. Four of the 300-ton jacks were furnished by the jacking contractor, and the railroad company purchased the remaining jacks, consisting of four 300-ton and eight 500-ton. The equipment purchased also included a 35-hp. 4-plunger hydraulic pump, electrically-operated, capable of delivering 1,000 cu.in. per minute, at 8,500 lb. per square inch pressure, and the requisite

LOOKING EAST from top of Air Line bridge, showing tracks leading to Grand Central Depot. In foreground fill is made for roadbed at higher level of raised bridge.

LOOKING WEST *(left)* showing Air Line viaduct at left and B. & O. C. T. viaduct at right, crossing Pennsylvania tracks in foreground.

pipe lines for the distribution of water.

The successive stages of the lifting process were accurately determined in advance, and an articulated substructure, consisting of approximately 220 tons of iron castings, made to suitable dimensions, was purchased, together with about 97 tons of structural steel, for use in stabilizing the columns of castings which formed the supporting media, and in completing the framework for the symmetrical concrete-metal substructure which was formed to carry the bridge in its elevated position. During the jacking, with the movable span in the fully-open position, a wind velocity of 25 miles per hour was noted during one day, but no ill effect was produced.

When the bridge was originally constructed, the needs of the subsequent jacking operation received due cognizance, and the metallic superstructure was supported on a series of I-beam grillages, which left free spaces beneath the projecting corners of the superstructure, into which the jacking mechanism was subsequently placed.

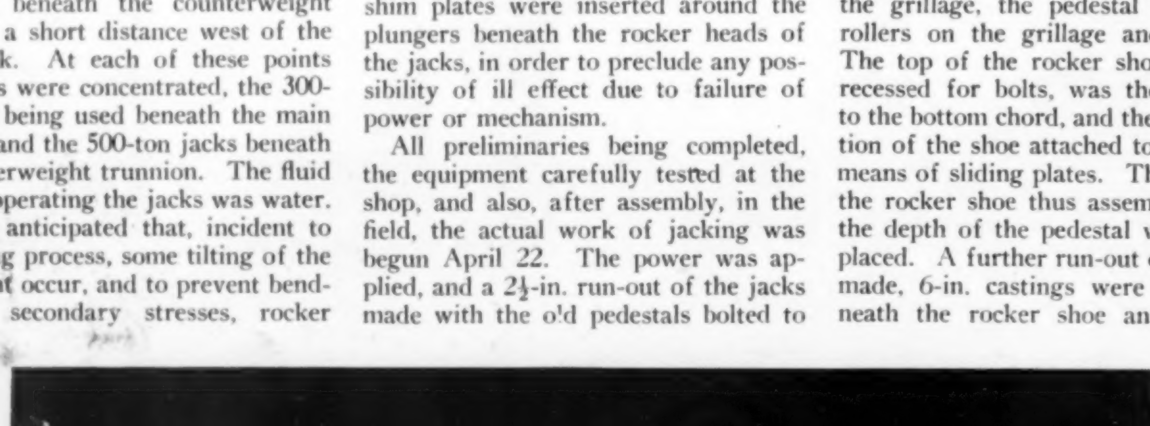
The power for lifting the bridge was applied at four points, two beneath the main trunnion, adjacent to the river, and two beneath the counterweight trunnion, a short distance west of the river bank. At each of these points four jacks were concentrated, the 300-ton jacks being used beneath the main trunnion and the 500-ton jacks beneath the counterweight trunnion. The fluid used for operating the jacks was water.

It was anticipated that, incident to the jacking process, some tilting of the span might occur, and to prevent bending and secondary stresses, rocker

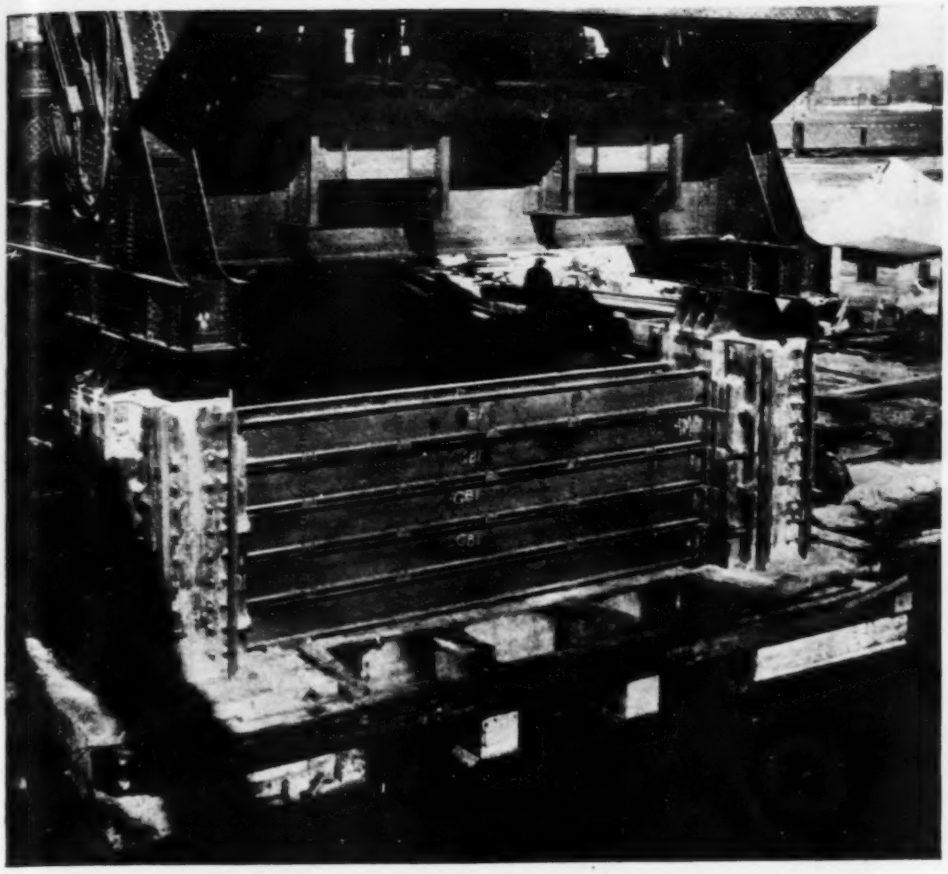
MAIN TRUNNION SHOE raised 21 in. and held by three 6-in. castings and three 1-in. plates. Main trunnion was held at this height during insertion of 21-in. castings over rocker shoes and jacks at counter weight trunnion.

shoes were used and each jack was equipped with a rocker or tilting head. During the progress of each run-out shim plates were inserted around the plungers beneath the rocker heads of the jacks, in order to preclude any possibility of ill effect due to failure of power or mechanism.

All preliminaries being completed, the equipment carefully tested at the shop, and also, after assembly, in the field, the actual work of jacking was begun April 22. The power was applied, and a $2\frac{1}{2}$-in. run-out of the jacks made with the old pedestals bolted to the bottom chord, after the anchor-bolt nuts had been removed. The anchor bolts were then burned off flush with the grillage, the pedestal lowered to rollers on the grillage and removed. The top of the rocker shoe, which is recessed for bolts, was then attached to the bottom chord, and the lower portion of the shoe attached to the top by means of sliding plates. The height of the rocker shoe thus assembled equals the depth of the pedestal which it replaced. A further run-out of 4 in. was made, 6-in. castings were placed beneath the rocker shoe and the jack



INSIDE NEW BRIDGE SUPPORT with all steel in place and grout poured in wells and castings. Anchor pin at base of castings was made to enter top of original grillage.



FINISHED STEEL SUPPORT for bridge, as seen from river side. Original shoes have been set back in their normal place in lieu of rocker shoes used during erection.

trays, and the weight of the bridge caused to rest thereon. This operation occurred simultaneously beneath the main trunnion and counterweight trunnion.

A further run-out of 9 in. was made, and, when a height of 21 in. had been attained the rocker casting was detached from the lower chord, an iron casting 21 in. in depth substituted, and the rocker casting, in turn, bolted to the underside of this casting. Incident to this change, the capacity of the jacking equipment underwent a severe test, as, during a period of four hours, the entire weight of the bridge rested upon the jacks, during which interval no perceptible recession occurred. After the insertion of the 21-in. casting between the rocker casting and the underside of the bottom chord, a shorter casting of similar depth was attached to the bottom chord immediately over each battery of jacks; these castings were aligned with the long castings over the rocker castings and secured thereto by means of bolts. The raising and lowering of the 300-ton and 500-ton jacks was accomplished by means of track jacks, resting upon the bottom flanges of the bridge, connected to the large jacks by means of cables.

In successive run-outs of the jacks, and the corresponding addition and rearrangement of parts in the articulated substructure, the work proceeded during the ensuing six days, until the desired final elevation was attained April 29, one week after the jacking had commenced. The actual jacking consumed 36 hours. As the raising of the bridge progressed, the supporting columns were built up by the addition of successive castings and stabilized by attachment of structural steel parts. Parallel with the river, beneath the main and counterweight trunnions, this bracing was so disposed as to form a complete web between the supporting columns; parallel with the center line of track it was arranged in the form of stepped counterforts. Around and outside of the structure, timber cribbing was erected to serve the need of a working platform for placing the castings and structural steel, and other operations incident to the work.

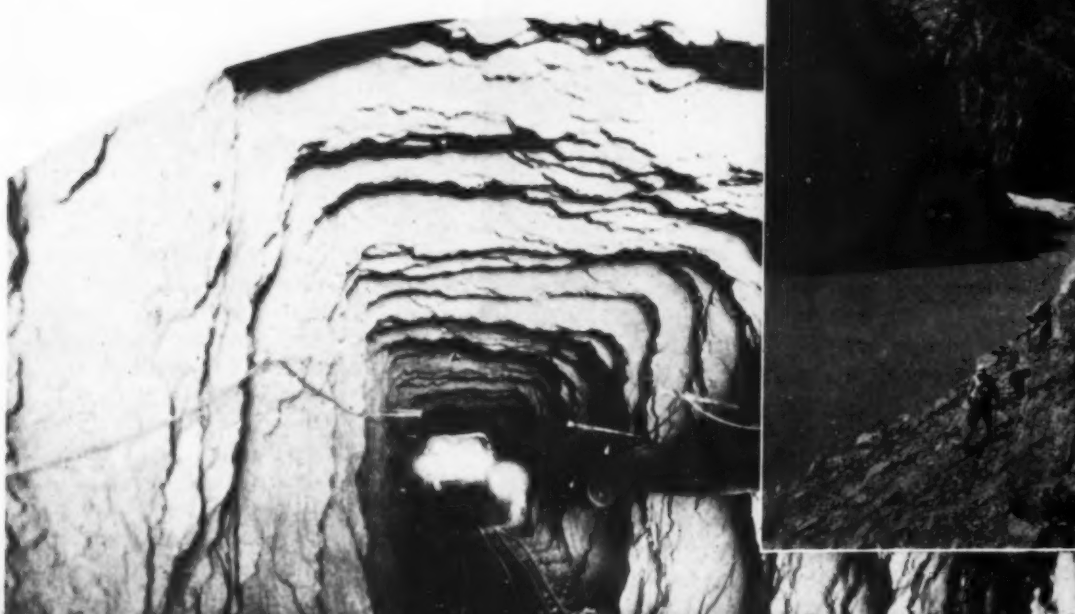
The development of plans and procedure for this work was handled by the writer under L. G. Curtis, chief engineer, B.&O.C.T.R.R.. During the field operations, the railroad company was represented by H. D. Clark, field engineer, assisted by H. W. Wilcox, Inspector. The progress photographs, some of which are used to illustrate this article, were made by Mr. Wilcox.

The actual jacking was performed by the Ferro Construction Co. of Chicago, as contractors, using jacking equipment purchased by the railroad company from the Watson-Stillman Co. of New York.

CONCRETE ENCASEMENT around new bridge support, showing old masonry below new.

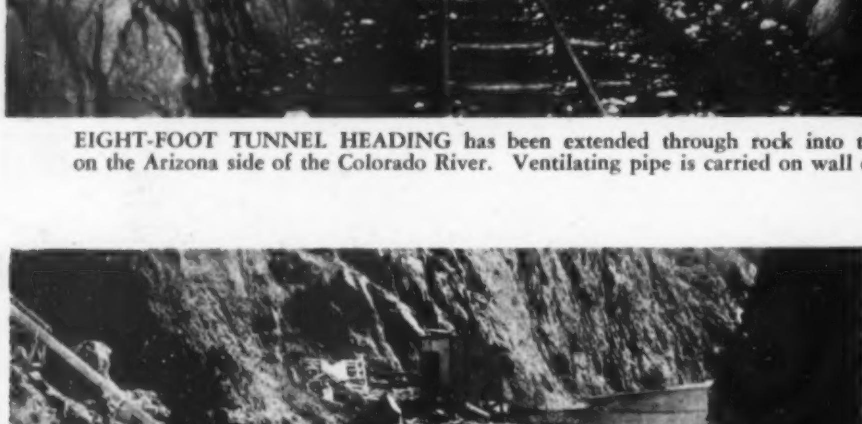
Construction Sets Quicker Pace at HOOVER DAM

SCALING LOOSE ROCK from canyon walls. Note, also, wire rope cables for suspension bridges to carry compressed air pipe lines across river.

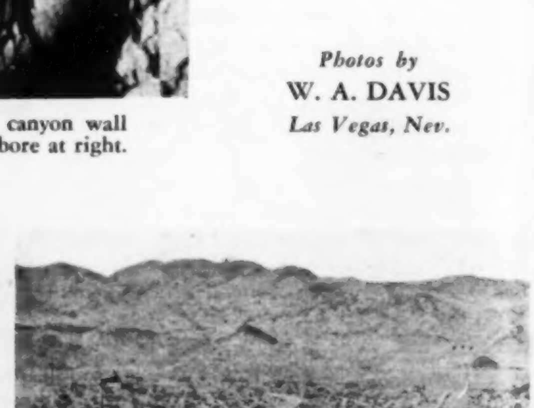


EIGHT-FOOT TUNNEL HEADING has been extended through rock into the canyon wall on the Arizona side of the Colorado River. Ventilating pipe is carried on wall of bore at right.

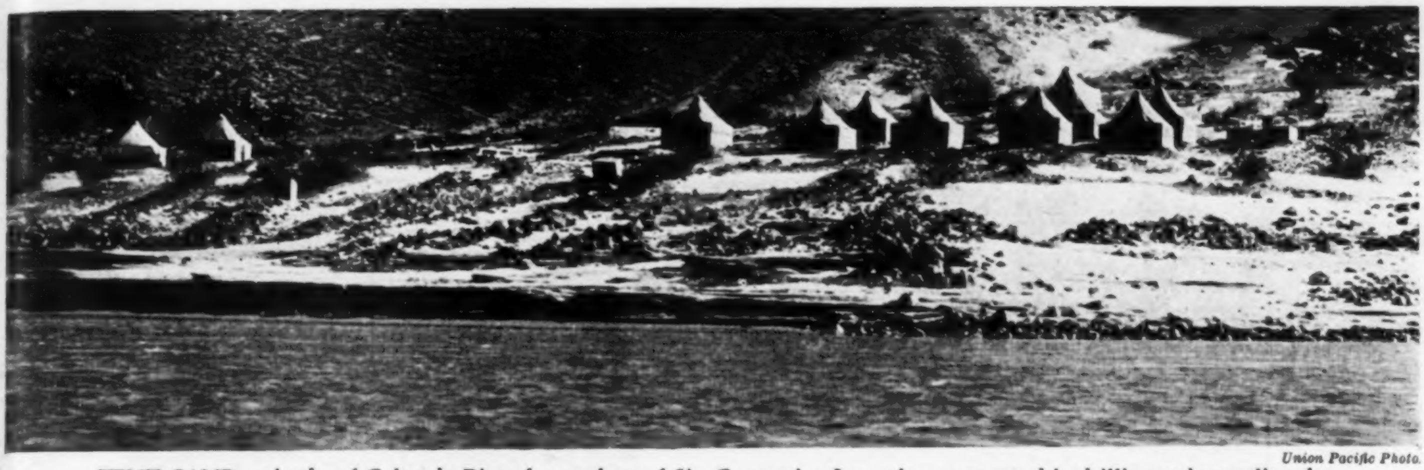
Photos by
W. A. DAVIS
Las Vegas, Nev.



PUMPING STATION is being constructed below outlet of diversion tunnels on Nevada side of river. It will deliver Colorado River water to Boulder City, involving lift of 650 ft.



STEEL PIPE LINE, 10 and 12 in. in diameter, is being laid by Wheelright Construction Co. to carry water 35,000 ft. from Colorado River to 2,000,000-yd. storage tank in Boulder City.



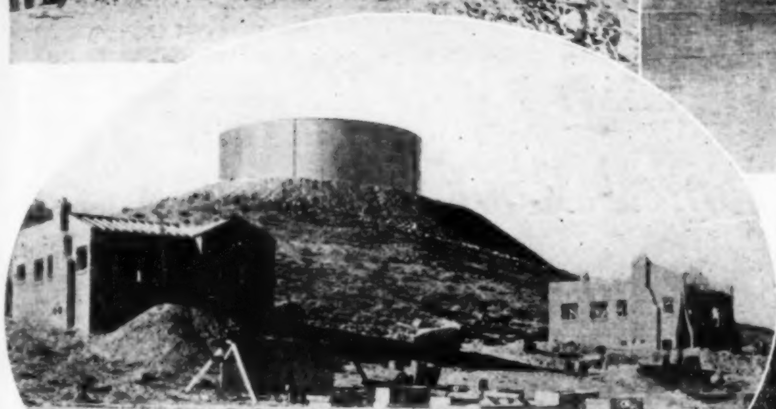
Union Pacific Photo.

TENT CAMP on banks of Colorado River for workers of Six Companies, Inc., who are engaged in drilling and tunneling the canyon walls for a railroad to deliver sand and gravel and remove tunnel spoil.

AIR COMPRESSOR PLANT *(below)* of three 4,000-cu.ft.-per-minute units is being set up on Nevada side of river below diversion tunnels.

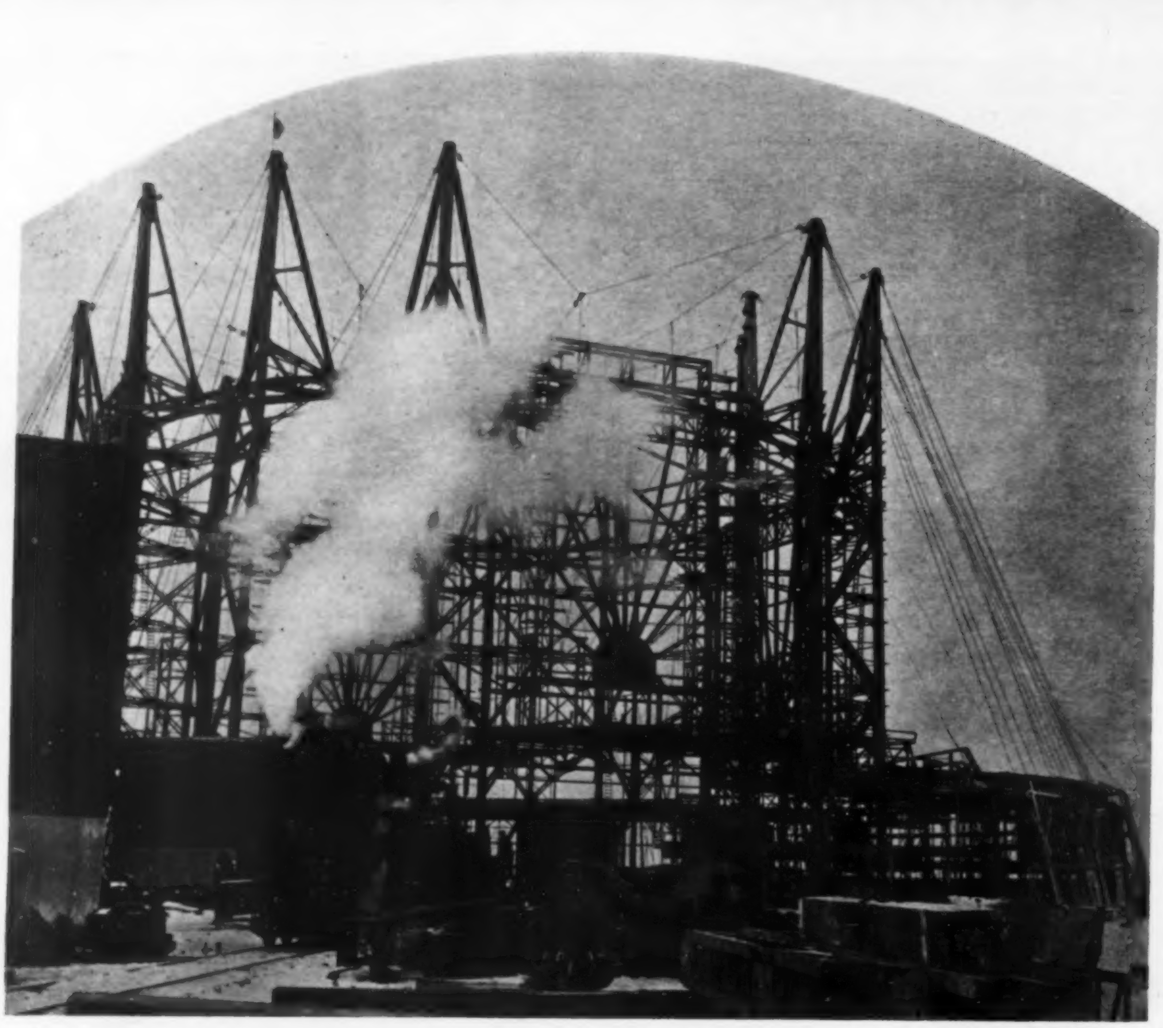
LOOKING UPSTREAM from below the site of the Hoover Dam. In foreground at right, which is the Arizona side, may be seen portal of one of the diversion tunnels.

©Union Pacific Photo.



DWELLING HOUSES *(above)* for Bureau of Reclamation engineers are first brick structures to be erected in Boulder City. Elevated water storage tank in background.

MARKING *(right)* on canyon walls of Colorado River location of one of the outlets of the four diversion and spillway tunnels.



WIRE ROPE CABLES from trussed steel columns support dome-shaped roof, 200 ft. in diameter, for Travel and Transport Building at Chicago's Century of Progress Exposition.

WIRE ROPE CABLES

Support Domed Roof of Chicago Exposition Building

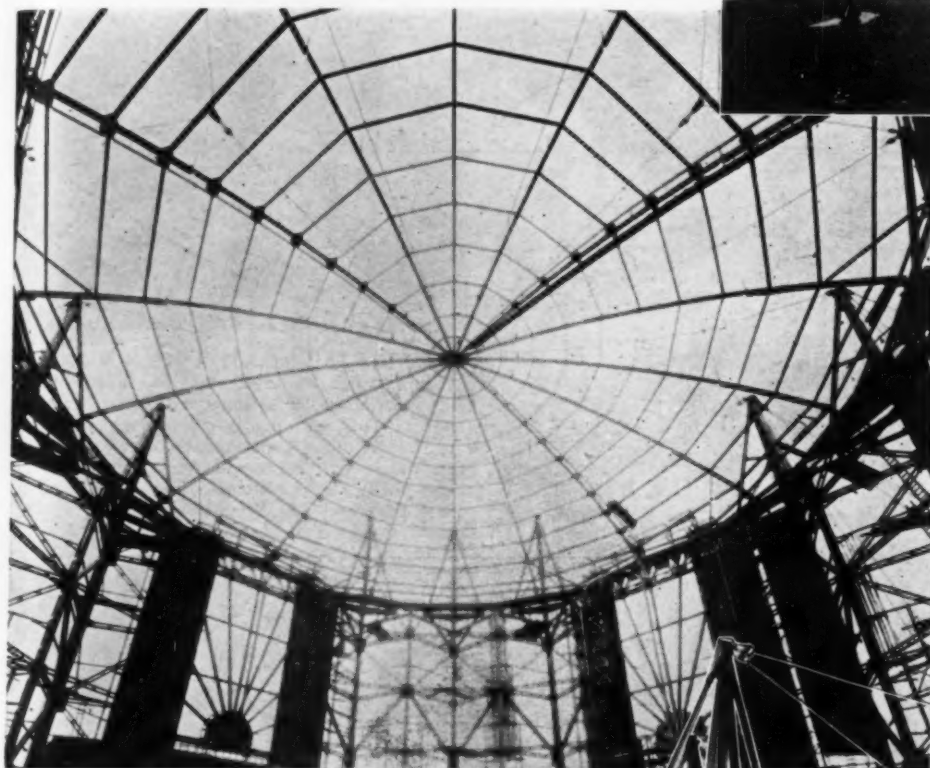
COLUMNS are 150 ft. high and consist of steel I-beams fabricated in section of a cross. Stiffening is provided by trusses on inside. Each tower is mounted on a rocker base.

WIRE suspension cables strung between the tops of trussed steel columns are the novel means employed to support the circular domed roof of the Travel and Transport Building being constructed to house one of the exhibits for Chicago's Century of Progress Exposition, to open June 1, 1933. The dome of the structure, suspended by vertical hanger rods spaced 16 ft. apart along the suspension cables, covers a circular building with an inside clear height of 125 ft. and a diameter of 200 ft. The twelve columns carrying the roof cables are each 150 ft. high, arranged in groups of three at each quadrant and are supported by rocker bearings at equal distances around the circumference of a 212-ft. circle. In a 300-ft. circle concentric with the ring of columns are anchorages for the column backstay cables. The general effect sought for in the design of the struc-

ture is that of a railway roundhouse, with tracks inside radiating from a central turntable for the exhibit of locomotives.

Each of the cable-carrying towers has a main column fabricated of two small steel I-beams with their flanges riveted to the web of a large main I-beam producing the section of a cross. The main column is trussed on its inner side to create the required stiffness. Wing gusset plates at the heads of the columns provide means for

ROOF SUPPORT *(right)* is by means of vertical hangers spaced at intervals of 16 ft. along the main suspension cables.



DOMED ROOF *(left)* is built of radial 16-in. steel I-beams curved vertically to rise 19 ft. and connected by I-beam purlins.

BACKSTAY CABLES *(below)* at inclination of 70 deg. with horizontal extend from column tops to concrete anchorages.

the attachment of the suspension cables of the domed roof and the backstay cables, both supplied by the American Steel & Wire Co.

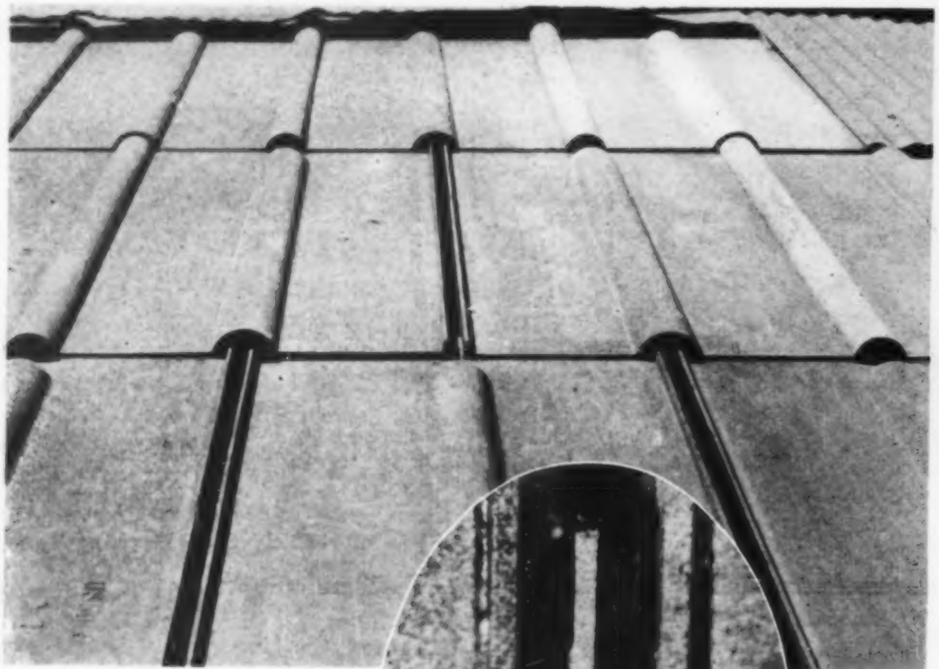
For the dome the framing consists of radial 16-in. I-beams curved vertically to a rise of 19 ft. and connected by I-beam purlins. This framing supports a deck of Holorib light cold-rolled steel channels.

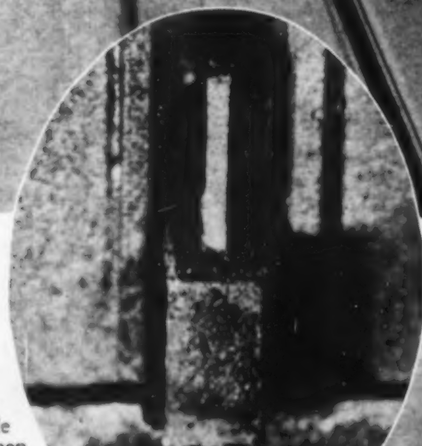
For supporting the dome-shaped roof $1\frac{7}{8}$-in. suspension cables extend between pairs of columns with a sag of 25 ft. Vertical hanger rods extend from each cable to the roof. Backstay cables are at an angle of 70 deg. from the horizontal, this steep inclination necessitating $2\frac{1}{8}$-in. cables. Each anchorage is a 30x21-ft. concrete block, 9 to 11 in. thick, with a steel anchor frame imbedded in it.

The unusual building was designed by a board of architects comprising E. H. Bennet, H. Burnham and J. A. Holabird. Daniel H. Burnham is director of works and John Griffith & Son Co., the contractor.

NEW EQUIPMENT *on the Job*

CONCRETE VIBRATOR for settling and compacting dry concrete. Made in two types, one to be used on flat slabs, beams or girders, and the other to be clamped on walls, mass concrete or concrete product forms. Equipped with air-driven, eccentric rotor controlled by amount of air pressure.—A. W. Munsell, 999 West Side Ave., Jersey City, N. J.



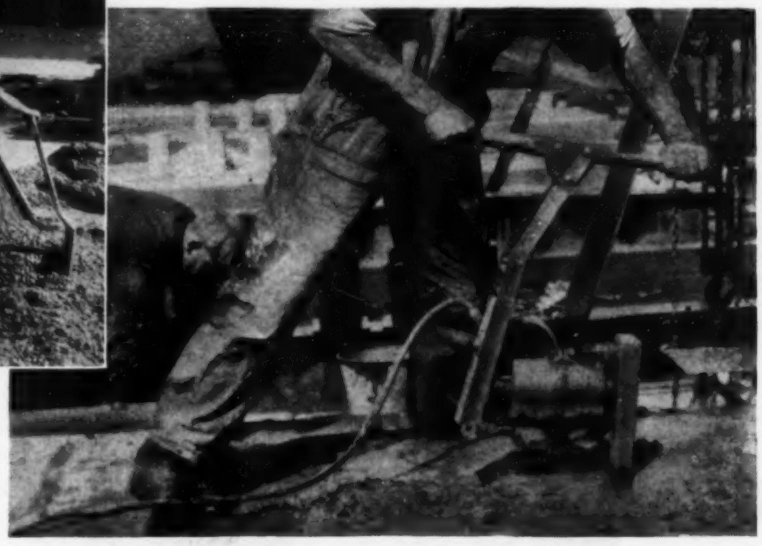


CAST-IRON PLATE ROOFING for heavy service roofs consists of plates 2 ft. wide, 4 ft. 4 in. long, $\frac{3}{16}$ in. thick, each weighing 78 lb. Semi-cylindrical rib extends along center of each plate. Two lateral edges of plate have upward extending rib 1 in. high from end to end. Stop on either side of top edge holds plate in place between purlins. Longitudinal joint between adjacent plates is covered by semi-cylindrical casting whose lower side has a lug near bottom and which passes down between edges of two roofing plates and receives wedge key *(in oval)* passing under top flange of the I-beam or channel purlin on which plate rests. Key locks strip securely in place. Second course of roofing plates is staggered, middle rib of upper course lapping over capping strip at joint of plates in course below.—U. S. Pipe and Foundry Co., Burlington, N. J.

AUTOMATIC GRAVITY TRACTOR DUMP UNIT for use in earth-moving. Struck capacity 3 cu.yd., or 5 cu.yd. with sideboards. Supplied with crawler mounting or on steel or pneumatic-tired wheels. Body dumps by gravity and is fitted with two spring-mounted chains to absorb shock of dumping. Dual control arrangement with an operator's seat facing in each direction assures ease of operation. Bulldozer attachment, auxiliary equipment. Power unit, McCormick-Deering 10-20 tractor.—Shunk Manufacturing Co., Bucyrus, Ohio.

REDUCTION IN DEAD WEIGHT *(left)* by air-cooling and modern automotive-type engineering design enables 320-cu.ft. air compressor to be transported easily over rough country. Elimination of water-cooling parts simplifies construction. Division of compressor load over four cylinders instead of two provides smoother operation with less wear and tear on compressor and engine. Mounted on steel treads or rubber tires and on skids for motor truck.—Davey Compressor Co., Kent, Ohio.

CONCRETE VIBRATOR *(below)*, electrically operated, eliminates hand spading and rapping of forms. Aids distribution of dry concrete around structural and reinforcing members. Shown with spud attachment for bridge deck and floor construction. Consists of semi-rigid handle, attached by ordinary rubber or canvas belt to top half of motor case, which enables operator to hold machine and escape its vibration. To bottom of motor case is bolted a wood or metal spud which goes between reinforcing members and reaches form. — Electric Tamper & Equipment Co., 400 Madison St., Chicago, Ill.

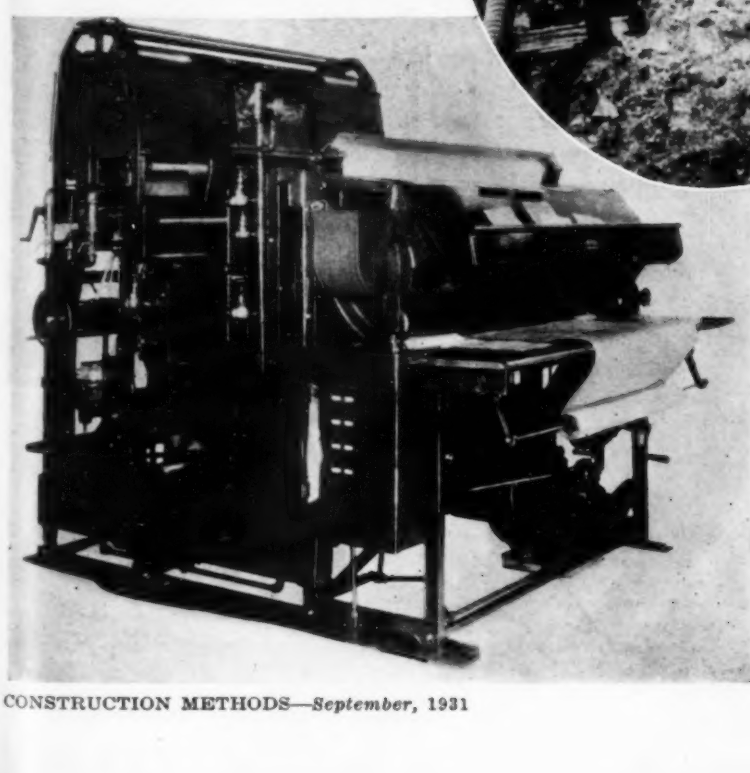


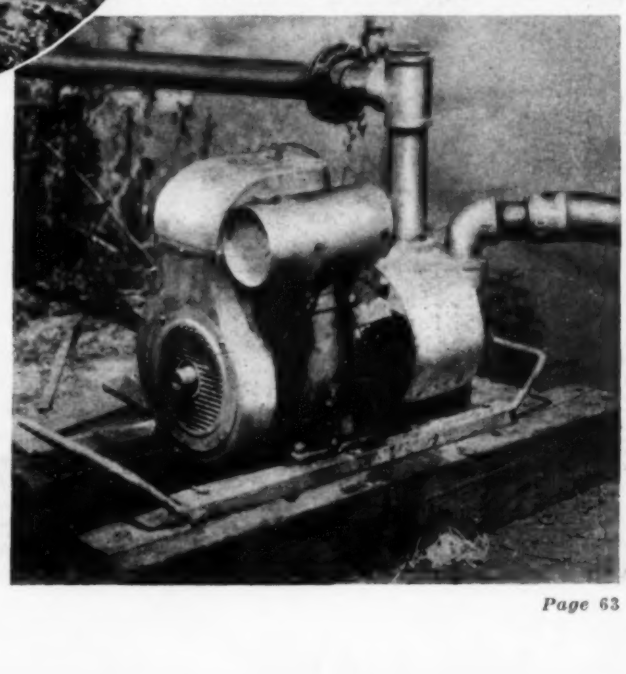
TRUCK MIXER AND AGITATOR has five-step mixing action accomplished by clockwise rotating and without reversing direction. Egg-shaped drum with twelve-sided panel design. Full control of discharge—fast, slow or intermittent. Positive discharge —no hoisting or tilting of drum. Adaptable to any make of truck. Separate power unit. Roller and ball-bearing drum support. Two sizes: 1—1½ cu.yd. has capacity of 1 yd. as mixer and 1½ yd. as agitator; 2—3 cu.yd. has capacity of 2 cu.yd. as mixer and 3 cu.yd. as agitator.—National Equipment Corporation, Milwaukee, Wis.

SELF-PRIMING CENTRIFUGAL PUMP *(left)*, a self-contained unit capable of priming itself whenever necessary and providing all suction lifts attained by centrifugal pumps. Has steel impeller of open type, making it possible for pump to handle large portion of solids, such as sand, gravel and silt. Self-cleaning. Built in 3-, 4- and 6-in. sizes, with capacities ranging from 400 to 1,400 g.p.m. Truck or skid mounted.—Novo Engine Co., Lansing, Mich.

BLUE PRINTING EQUIPMENT *(below)* designed to meet demands of moderate budget. Composed of three units—blue-printing machine, washing machine and potashing, washing and drying machine. All units made in two sizes, 42 in. and 54 in. wide; can be used to operate on 220 volts, d.c. or a.c.—C. F. Pease Co., 813 N. Franklin, Chicago, Ill.

AUTOMATIC, POSITIVE PRIMING CENTRIFUGAL PUMP *(below)* discharging water through 500 ft. of 3-in. line on a road construction job near Oklahoma City, Okla., Union Construction Co., contractor. Suction lifts up to 29 ft. Pumps air or water or mixture of air and water. Crankshaft mounted on Timken roller bearings. Vertical single-cylinder air-cooled four-cycle engine developing more than 5 hp. at 1,800 r.p.m. Capacities, 10- to 90-ft. heads, 18,960 to 2,760 gal. per hour.—Sterling Machinery Corp., 2303 Holmes St., Kansas City, Mo.





Present and Accounted For —

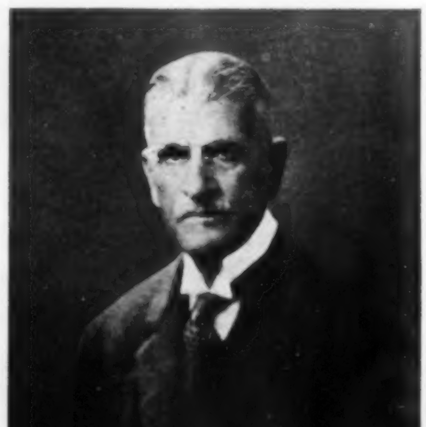
A Page of Personalities

E. J. MEHREN, formerly vice-president and editorial director of the McGraw-Hill Publishing Co., resigned Sept. 1 to become president of the Portland Cement Association. Mr. Mehren for many years served as editor of *Engineering Record* and of *Engineering News-Record*. In appointing Mr. Mehren, the Portland Cement Association for the first time has gone outside the ranks of the cement manufacturers for its executive head.

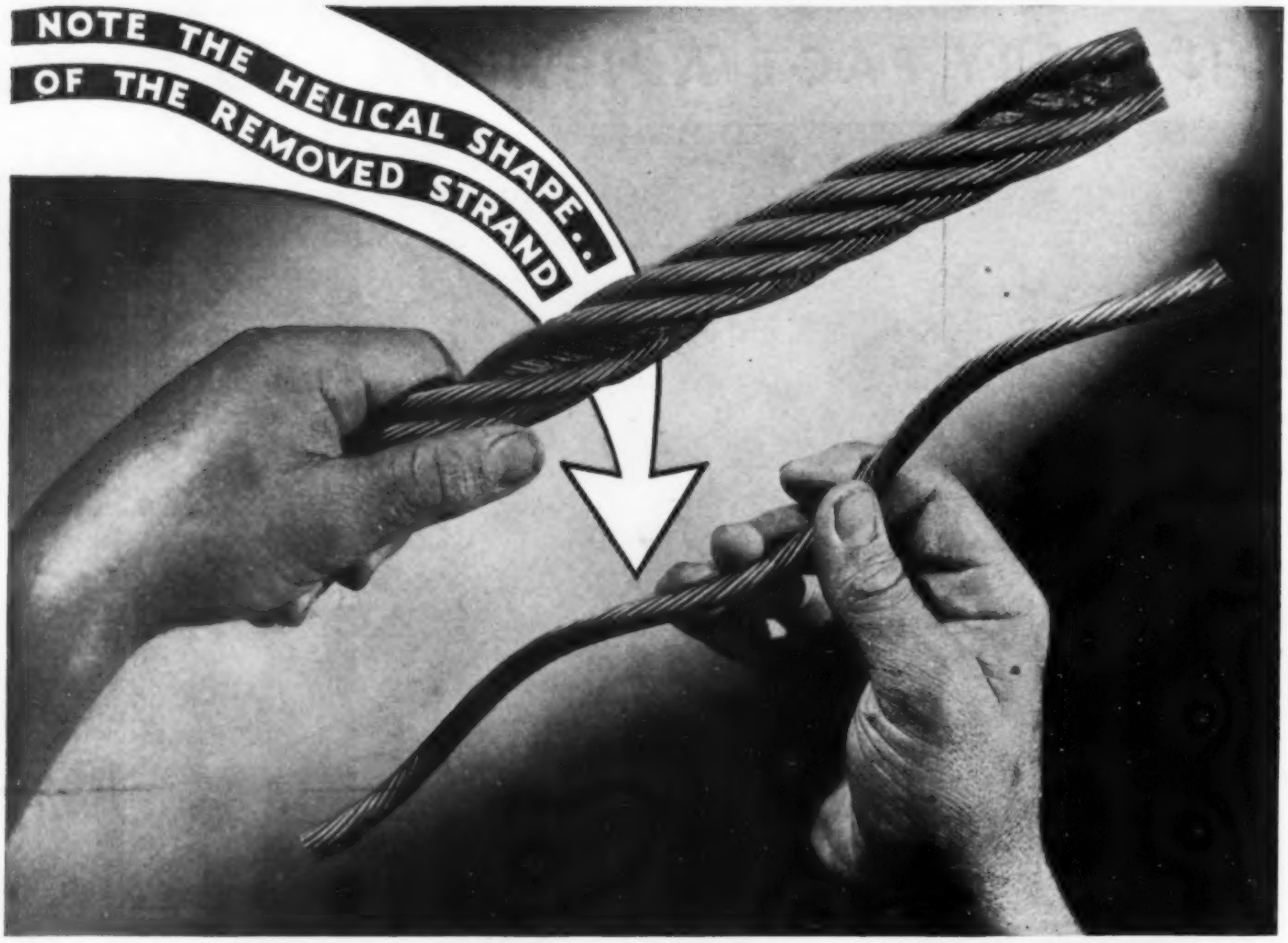
JOSEPH A. TOMASELLO, member of the firm of A. G. Tomasello & Son, Inc., general contractors of Boston, Mass., is serving a second term as president of the New England Road Builders' Association. Last month the Italian Consul at Boston, on behalf of the King of Italy, decorated Mr. Tomasello as Knight of the Order of the Crown of Italy.

O. H. AMMANN, chief engineer of the Port of New York Authority and designer of the Hudson River bridge with a main cable suspension span of 3,500 ft., has received from New York University the honorary degree of Doctor of Engineering.

F. C. BRETZ *(below)*, of Ayrshire, Ia., in spite of the handicap of blindness resulting from an explosion of dynamite two years ago, is carrying on his business as a road-building contractor. At the present time he is handling a 5½-mile grading job in Iowa, involving 122,000 cu.yd.



M. S. BLAIKLOCK, after more than 50 years of service, has retired as assistant chief engineer of the Canadian National Railways. He retains his position as chairman of the general co-operative committee of maintenance-of-way employees.



PREFORMING ADDS TO WIRE ROPE LIFE *BY 30% TO 300%!*

Preforming removes internal stress in wire rope. By preforming (preshaping) wires and strands so they are set to their exact helical form, wires and strands lie normally in place. In ordinary wire rope which is not preformed, wires and strands are forced to wind about each other with clockspring tension—there is a constant tendency to straighten out.

Witness this internal stress in ordinary wire rope when you cut it. The ends must be firmly seized to prevent unraveling. Lay-Set is non-raveling. Note in the illustration above (which is made from an actual unretouched photograph) that the wires and strands stay in position, even though the end is unseized.

Elimination of internal stress in Lay-Set Preformed Wire Rope adds 30% to 300% *additional* service, which varies, depending upon the character of the service and type of equipment. Lay-Set is particularly efficient on power shovels, cranes, drag lines and similar equipment which is as a rule severe on wire rope.

Put a reel of Lay-Set in your tool shed. Keep an accurate record of its performance and compare this service with that of ordinary wire rope. You will be surprised and convinced.

Let us give you additional information. Address:

HAZARD WIRE ROPE

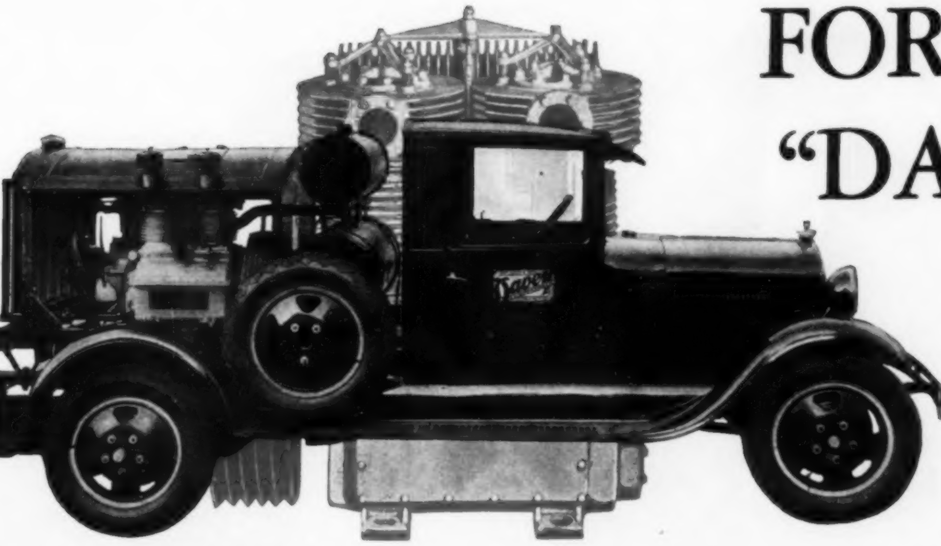
America's First Wire Rope—Since 1846

HAZARD WIRE ROPE COMPANY
WILKES-BARRE, PENNSYLVANIA

New York · San Francisco · Pittsburgh · Chicago · Birmingham · Denver · Philadelphia · Fort Worth · Los Angeles · Tacoma

HAZARD LAY-SET PREFORMED WIRE ROPE

FORD *and* "DAVEY"



The method of cooling air compressors through the use of metals of high heat conducting quality and capacity, as contained in Davey Compressors, is fully protected by patent.

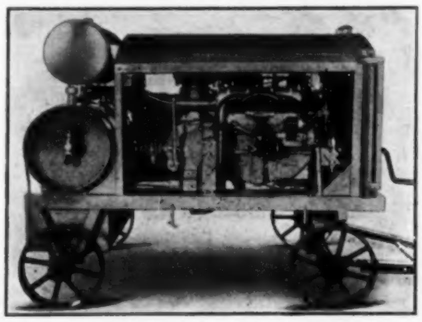
"TEAM-MATES" *in motor and compressor performance . . .*

THE DAVEY COMPRESSOR, POWERED BY THE FORD INDUSTRIAL MOTOR

Wherever you need a dependable supply of compressed air, you get it quicker and cheaper from this Ford-powered Davey Compressor mounted on a standard Ford short wheel-base chassis. This combination outfit goes wherever you can drive a Ford car—gets there quick, starts with a twist of the crank, or the turn of a self-starter switch, and settles down to pumping air with the throw of a clutch.

Its extraordinary mobility is due to its light weight. The full-size 110 cu. ft. Davey Compressor unit uses aluminum alloys for the finned compressor heads and manifolds. This eliminates heavy cast-iron water jackets and other cooling paraphernalia. Hence the complete compressor outfit weighs fully 600 lbs. less than water-cooled combinations of similar capacity.

"Air-cooling," which retards carbon formation, is responsible for the Davey Compressor's 5-year reputation for sustained efficiency. The Ford Model "A" Industrial



Motor is famous everywhere for dependability and economy. Your engine maintenance problem is simplified through inter-changeability of parts between truck and compressor motors; Ford repair part service is available through 8500 distributors.

This same Ford-powered Davey Compressor is also available in skid-mounted form for use on your own truck, or may be had as a 4-wheeled trailer.

Contractors who have used this handy air-pumping outfit, even those who have merely inspected it, are enthusiastic about the possibilities it brings for added usefulness for air in construction and maintenance work. Be sure to see this Ford-powered Davey Compressor and get all the details.

Mail the coupon today.

DAVEY COMPRESSOR CO., Inc.
KENT, OHIO
Sales Representatives in All Principal Cities

Send for this new book—

—it tells the whole story of the punishing 500 hour test conducted by unbiased engineers on a Davey air-cooled compressor and 3 water-cooled machines.

—it tells the important facts about these tests, gives engineering data, and is full of comparative pictures and tables.

Before you select *any* air compressor, be sure to get this helpful book. Only a limited number available. No obligation on your part. Use the coupon below.

DAVEY Compressors AIR COOLED AIR

Davey Compressor Company, Inc., Kent, Ohio

☐ Send me full details about the new 110 cu. ft. Davey Compressor mounted on a Ford chassis; also send me, without obligation, a copy of the book "4 Air Compressors Went to School."

Name ____________

Street Address ____________

City ____________ State ____________

CM 9

and

discuss

DUAL CONTROL OF WELDING HEAT

"I want to congratulate you on the radio set you bought for me. So simple. The right knob gets my station and the left one tunes it up to wonderful tone."

"I had method in it. I wanted to prove to you the advantage of the Lincoln 'Stable-Arc' welder."

"How on earth?"

"Well, your old set had a single control and you nearly got music. It's that way with welders, so years ago Lincoln originated DUAL CONTROL of the welding heat."

"And what does that accomplish?"

"It gives you proper welding current at the right welding voltage throughout the range of the machine in just those two ways."

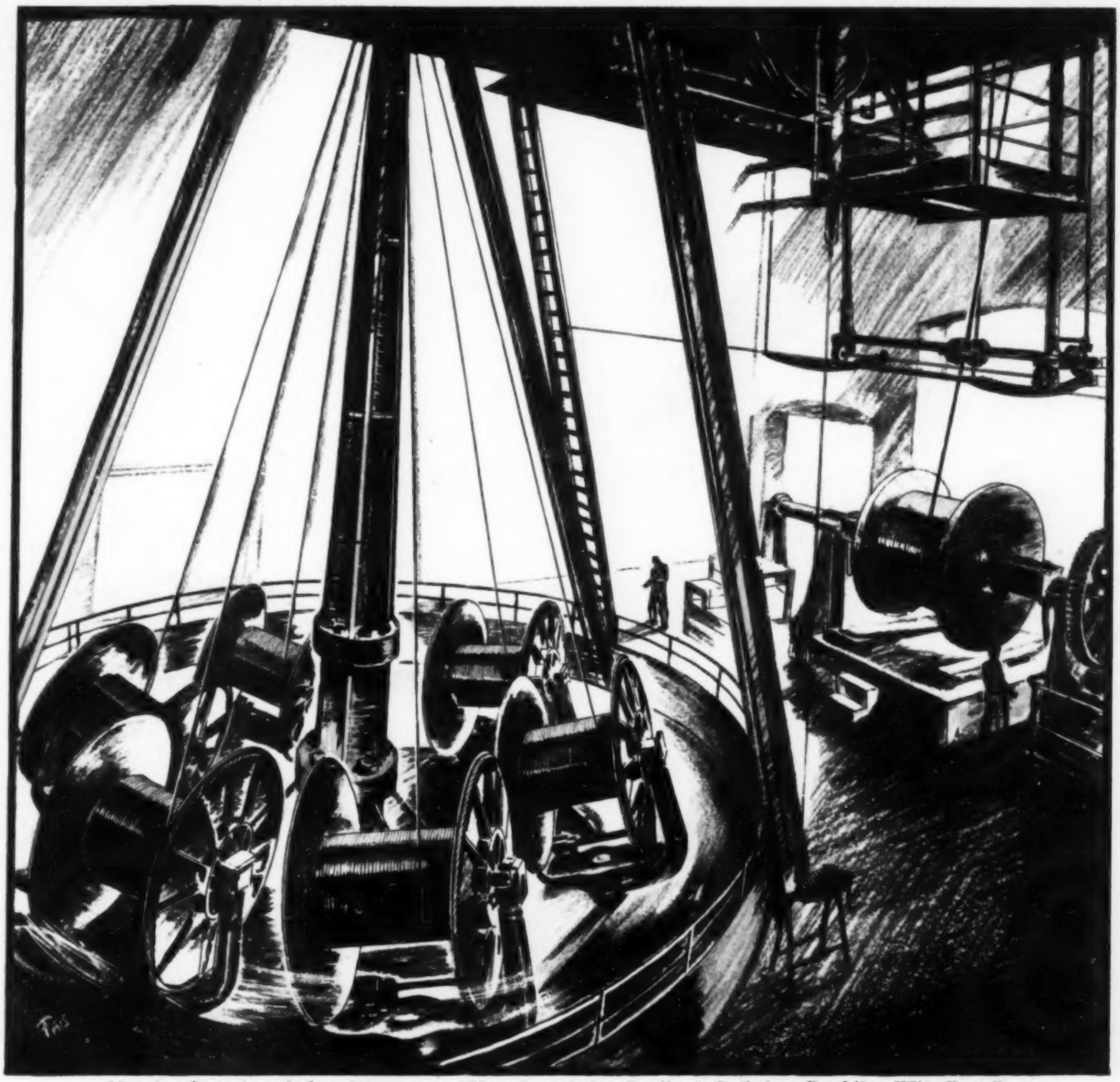
"Well, it's easy to see that the operator can do better and faster work with it."

"Not CAN do, but HAS BEEN DOING IT. More than that, it also means that these are the only welders that have been giving full capacity of the machine at the voltage required for that 'Shielded Arc' process also developed by

LINCOLN

THE LINCOLN ELECTRIC COMPANY, CLEVELAND, OHIO

Largest Manufacturers of Arc Welding Equipment in the World W-187



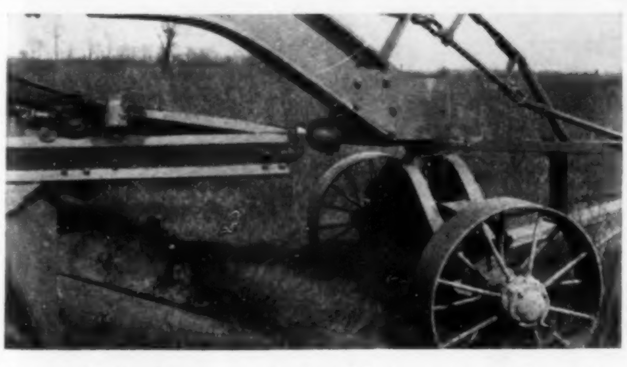
Announcing

THE NEW Austin 101 LEANING WHEEL GRADER

This is the new Austin 101.

Absolutely unequalled by any other grader for strength, capacity, durability, visibility, adaptability and flexibility.

Note bank cutting blade.



Note deep plowing cut made possible by universal connection.

The new Austin 101 is far more than just another grader. Because of a combination of proved features it will do more work, better work, and more kinds of work than any other grader we know of.

Operating ease has been so increased that the operator can do more work because he does not tire so easily. Features which lighten his task are power leaning of the wheels, an exclusive patented Austin Feature, the ease with which the massive blade may be raised and lowered, reversed and side shifted, and the ease with which the frame may be shifted on the axle.

Outstanding Strength

Other important features of the amazing Austin 101 are the massive one piece frame which provides far greater strength, the heavier rear axle, welded front axle and king post of unit construction, the use of Timken tapered roller bearings, hot riveted spokes, and 9-inch tires.

Durability

The principal gears have machine cut teeth and are made of steel, malleable iron or bronze. Steering worm and gears are enclosed and work in grease. These factors make the Austin 101 durable to a far greater degree.

Visibility, Adaptability, Flexibility

The operator of an Austin 101 has an unhampered vision. He has a grader that is extremely flexible without subjecting the frame to undue strain. He has a grader which is equally outstanding for heavy ditching or grading, widening roads, bank cutting, sloping, scarifying, or general maintenance.

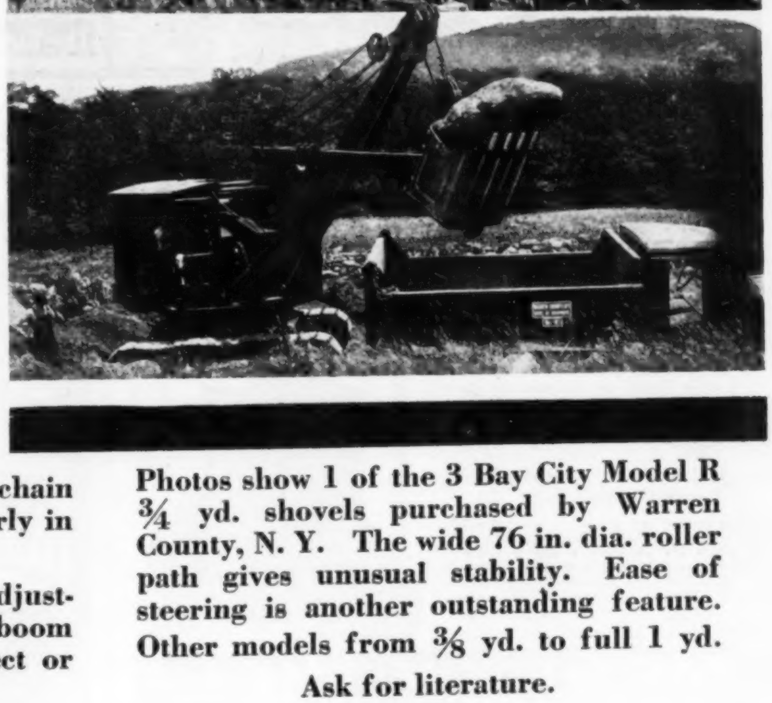
Write for FREE Booklet

Send for a new FREE Booklet on the Austin 101 which contains a detailed description and mechanical specifications. Your copy of this valuable booklet will be sent you by return mail. The Austin-Western Road Machinery Co., 400 N. Michigan Avenue, Chicago, Illinois. Branches in principal cities.

Austin-Western
ROAD MACHINERY

3 Bay City Model R
3/4 yd. Shovels
installed in June
for

WARREN COUNTY
New York



CHAIN CROWD IS POSITIVE *and it lasts!*

In trying to make every dollar count, consider what method of crowd is used on the shovel you purchase—whether chain or cable.

You can't get cable crowd on Bay City Shovels. All Bay City machines are equipped with chain crowd only. Bay City users prefer it—as we do.

Chain crowd permits vigorous shaking of bucket and fast, positively controlled forward or reverse crowd action. With chain crowd you can crowd with full engine power, independent of hoist. It also gives greater working range. The durability of the crowd chain saves users hundreds of dollars yearly in lost time and repair expense.

The Bay City patented crowd chain adjustment permits any change in the boom angle without stopping to disconnect or adjust the chain length.

Photos show 1 of the 3 Bay City Model R 3/4 yd. shovels purchased by Warren County, N. Y. The wide 76 in. dia. roller path gives unusual stability. Ease of steering is another outstanding feature. Other models from 3/8 yd. to full 1 yd.

Ask for literature.

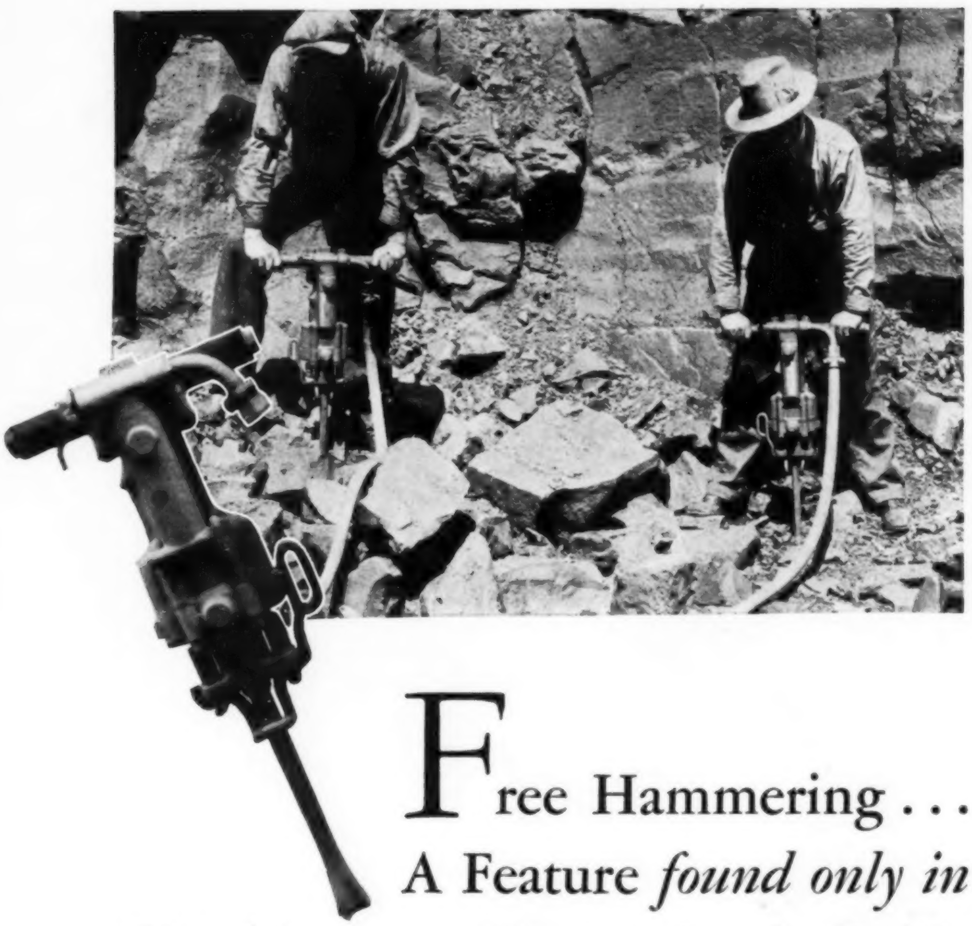
BAY CITY SHOVELS, Inc., Bay City, Mich.
Eastern Office: Roselle Park, N. J.

BAY-CITY SHOVELS

THE BAY-CITY FAMILY OF FAST WORKERS

ALPHABETICAL INDEX TO ADVERTISERS

This index is published as a convenience to the reader. Every care is taken to make it accurate, but *Construction Methods* assumes no responsibility for errors or omissions.



Automatic Independent Rotation... Piston is "Free Hammering" and practically unbreakable

Free Hammering...
A Feature *found only in*
Worthington-Gilman Rock Drills

ONLY in Worthington-Gilman Drills is the piston independent of the rotation. No grooves, no threads, no counterbores. Made in one solid bolt, the piston is more substantial...a rugged unit. Maintenance costs are lowered because the piston is practically immune from breakage.

The piston has just one job to do...to deliver its blow on the drill steel. Short stroking and retardation are eliminated.

There is a Worthington-Gilman drill for every phase of road building. High speed drifters for sewer and vehicular tunnels...rock hammers for ledge work, open cuts and boulder popping. There is no situation that cannot be met.

Worthington engineers will be glad to discuss your problems with you and show you the way to lower costs. *Write for literature on the type of equipment in which you are interested.*

PUMPS
All Sizes...All Types
For All Services
Any Capacity...Any Pressure
COMPRESSORS
Stationary and Portable
CONDENSERS
and Auxiliaries
DIESEL ENGINES
GAS ENGINES
FEEDWATER HEATERS
WATER, OIL and GASOLINE METERS
MULTI-V-DRIVES
ROCK DRILLS
AUTOMATIC HEAT TREATING MACHINES FOR DRILL STEEL
FORGING FURNACES FOR DRILL STEEL
DRILL STEEL
ACCESSORIES
CHROMIUM PLATING

Literature on request

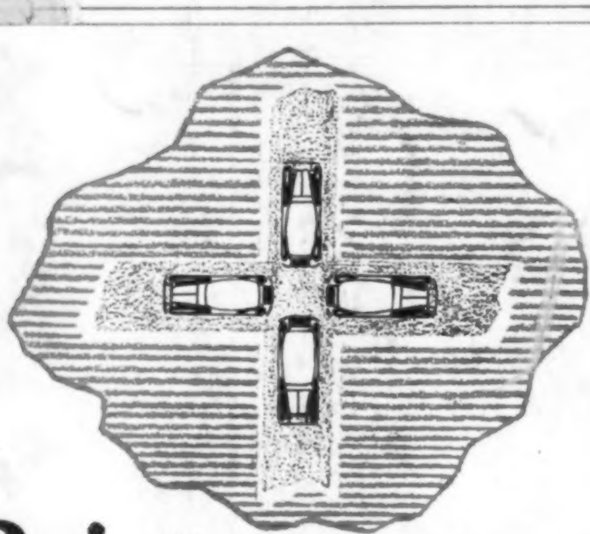
WORTHINGTON PUMP AND MACHINERY CORPORATION
Works: Harrison, N. J. Cincinnati, Ohio Buffalo, N.Y. Holyoke, Mass.
Executive Offices: 2 Park Avenue, New York, N.Y.
GENERAL OFFICES: HARRISON, N. J.
District Sales Offices and Representatives:

ATLANTA	CHICAGO	DALLAS	EL PASO	LOS ANGELES	PHILADELPHIA	ST. PAUL	SEATTLE
BOSTON	CINCINNATI	DENVER	HOUSTON	NEW ORLEANS	PITTSBURGH	SALT LAKE CITY	TULSA
BUFFALO	CLEVELAND	DETROIT	KANSAS CITY	NEW YORK	ST. LOUIS	SAN FRANCISCO	WASHINGTON

Branch Offices or Representatives in Principal Cities of all Foreign Countries

WORTHINGTON

T-22



Point your car
in any direction
(east of the Rockies)

This durable, attractive surface on State Road No. 74, near Palatka, Florida, is a result of the use of Texaco Macadam Binder.

—and start driving.

The frequency with which you find a Texaco Asphalt street or highway under your automobile will impress you.

Hot-mixed Texaco Asphalt paving in one place. Further along, it is Texaco Asphalt Macadam. Then a long stretch of low-cost secondary road, built with Texaco Surfacing Material or Texaco Cut-back.

Later, your car strikes a brick pavement, the joints of which are waterproofed and weatherproofed with Texaco Paving Filler.

Time and again, you speed smoothly over pavements patched with a hot or cold Texaco Asphaltic product.

The past quarter of a century has seen a steady increase in the tonnage of Texaco Asphalt used in the construction and maintenance of America's streets and highways.

This Texaco Sheet Asphalt Pavement on Fletcher Avenue, Chicago, carries considerable traffic, including many trucks. It shows no sign of its seven years' service.

TEXACO
asphalt

New York
Philadelphia
Richmond
Boston
Jacksonville

The Texas Company
ASPHALT SALES DEPT.
135 E. 42nd Street, New York City

Chicago
Cleveland
Kansas City, Mo.
Houston
Dallas
Buffalo